SITES 26EK3032, LOCALITIES 26 AND 27, AND 26EK3516: AN ARCHAEOLOGICAL TESTING PROGRAM AT TOSAWIHI QUARRIES

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Prepared for
Bureau of Land Management
Elko Resource Area

On behalf of
Ivanhoe Gold Company
P.O. Box 2667
Winnemucca, Nevada 89445

Prepared by
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Drawer A
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CULTURAL RESOURCES MANAGEMENT SUMMARY

Intensive minerals exploration and extraction is proposed in the Ivanhoe Mining District, located along Little Antelope Creek, Elko County, Nevada, on lands administered by the Bureau of Land Management, Elko Resource Area (BLM).

Intermountain Research conducted archaeological tests on behalf of Ivanhoe Gold Company, in response to impacts anticipated as a result of two separate mine-related construction activities in and around the Tosawihi Quarries, archaeological site 26Ek3032. The larger of the proposed actions involved engineering changes to ore processing facilities in the vicinity of Little Antelope Creek. These developments portended impacts to two archaeological locations additional to those addressed in earlier work (Elston 1989). Both of these are components of the Tosawihi Quarries, a National Register property: Locality 26, a quarry pit complex and Locality 27, an open residential site. As such, testing in this area was undertaken for the purpose of developing a data recovery plan (see Intermountain Research 1988e). Subsequent to testing, however, changes in mine design eliminated the need for further archaeological investigation. Results of the testing fieldwork are reported here.

The second testing exercise addressed potential impacts posed by realignment of a southern segment of the proposed Main Access Road linking Ivanhoe Gold Company's Hollister Mine with State Route 18 (Intermountain Research 1988c). Testing was undertaken with the goal of clarifying the National Register of Historic Places eligibility status of previously identified archaeological site 26Ek3516, located just outside and adjacent the northwestern boundary of the Tosawihi Quarries (Intermountain Research/BLM correspondence 11/11/88).

The present evaluation concludes that 26Ek3516 is ineligible for nomination to the National Register of Historic Places. We propose that testing recovered the full information content of the site and that construction of the Main Access Road to the mine will pose no adverse effects.

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ACKNOWLEDGEMENTS

Archaeological testing reported here was carried out under the direction of Robert G. Elston (Principal Investigator), Melinda Leach (Co-Principal Investigator), Christopher Raven and Steve Botkin (Project Supervisors). Stratigraphic analyses were conducted by Dan Dugas and Cari Inoway, assisted by Karen Lupo and Andy Carey. Field technicians included Kathy Ataman, Meg Burns, Fred Crisson, Steve Erven, Ellen Glassmeyer, Margaret Hangan, Bruce Jones, Peter Kiigemagi, Ken Moslak, Susan McCabe, Thomas Ross, and Robert Webb. Michael Drews, Shelly Raven, and Bill Bloomer served as mappers.

Mr. Jimmy Olsen fed us, fixed things when they broke, and generously educated us on a variety of subjects. Trish Webb and Hill Ross assisted in the cook tent and helped with general camp chores. Cleo Ross managed to manage the field camp between trips to town for tire repairs, sundry supplies, and the odd emergency room visit required by experimental quarriers and knappers.

Cataloguing activities were performed by Michael Clerico, Evangeline Elston, Bill Germino, Theresa Hamby, Janna Hembree, Susan McCabe, Joanne Shea and Wendy Stotts, under the supervision of Lynn Rogers. Artifact classifications and analyses were contributed by Lynn Rogers (historic artifacts), Dave Schmitt (groundstone, ceramics, and bones), Michael Drews (projectile points and preforms), and Kathy Ataman, Bill Bloomer, and Eric Ingbar (bifaces, specialized flake tools, and debitage). Dugas and Elston produced stratigraphic summaries and geomorphological analyses. Jonathan O. Davis analyzed tephra samples and Beta analytic, Inc. conducted radiocarbon analyses for the project. Test report production was facilitated by Kathy Nickerson; maps were prepared by Michael Drews. Cari Inoway drew artifact illustrations and Bill Germino crafted photographic plates.

Chapter 1

INTRODUCTION

Intensive minerals exploration and extraction is proposed in the Ivanhoe Mining District, along Little Antelope Creek, Elko County, Nevada (Figure 1). Activities focus on that portion of the district referred to as the Ivanhoe Project Area on lands administered by the Bureau of Land Management, Elko Resource Area (BLM).

This report documents the results of archaeological tests conducted by Intermountain Research on behalf of Ivanhoe Gold Company. The need for testing was triggered by impacts anticipated as a result of two separate mine-related construction activities in and around the site 26Ek3032, Tosawihi Quarries. Archaeological resources within each of the areas of potential effect held differing status in terms of the National Register of Historic Places. As a result, the focus and goals of the test programs within them were somewhat different.

The larger of the proposed actions involved engineering changes to ore processing facilities in the vicinity of Little Antelope Creek. These developments portended impacts to two archaeological locations (Figure 2) additional to those addressed in earlier work (Elston 1989). Both are components of the Tosawihi Quarries, site 26Ek3032, a National Register property: Locality 26, a quarry pit complex and Locality 27, an open residential site. As such, testing in this area was undertaken for the purpose of developing a data recovery plan. This goal was accomplished (Intermountain Research 1988e), and the plan appeared as an amendment to the second volume in a series of data recovery plans developed for the Ivanhoe Project (Intermountain Research 1988a, 1988b, 1988c, 1988d). Subsequent to testing fieldwork however, proposed changes in mine design were abandoned, eliminating the necessity for further investigation of Localities 26 and 27.

The second testing program reported here addressed potential impacts posed by realignment of a southern segment of the proposed Main Access Road linking the mine with State Route 18 (Intermountain Research 1988c; see Figure 2). In this case, testing was undertaken with the goal of clarifying the National Register eligibility status of previously identified site 26Ek3516, located just outside and adjacent the northwestern boundary of the Tosawihi Quarries (Intermountain Research/BLM correspondence 11/11/88).

In this report we present the outcome of the testing programs. For both, we rely heavily upon citation of extant archaeological literature on the Tosawihi vicinity for the portrayal of cultural and environmental context as well as for specifics of field methods and the rational for their application. Chapters 2 through 5 offer the findings of work at Localities 26 and 27, 26Ek3032. Chapter 2 provides an overview of the Localities 26, 27 study area, its physical setting and its cultural content. Chapter 3 outlines the field methods employed. The results of the testing program are encompassed by Chapter 4, commencing with a description of the content and structure of site deposits as revealed by stratigraphic analyses and followed by a description of the artifact assemblage. Chapter 5 concludes discussions of Localities 26 and 27 with a consideration of their data potential in light of their ability to address questions pertinent to Tosawihi research. The final chapter, Chapter 6, presents testing results for site 26Ek3516 and an assessment of the effect that proposed construction will have upon the site.

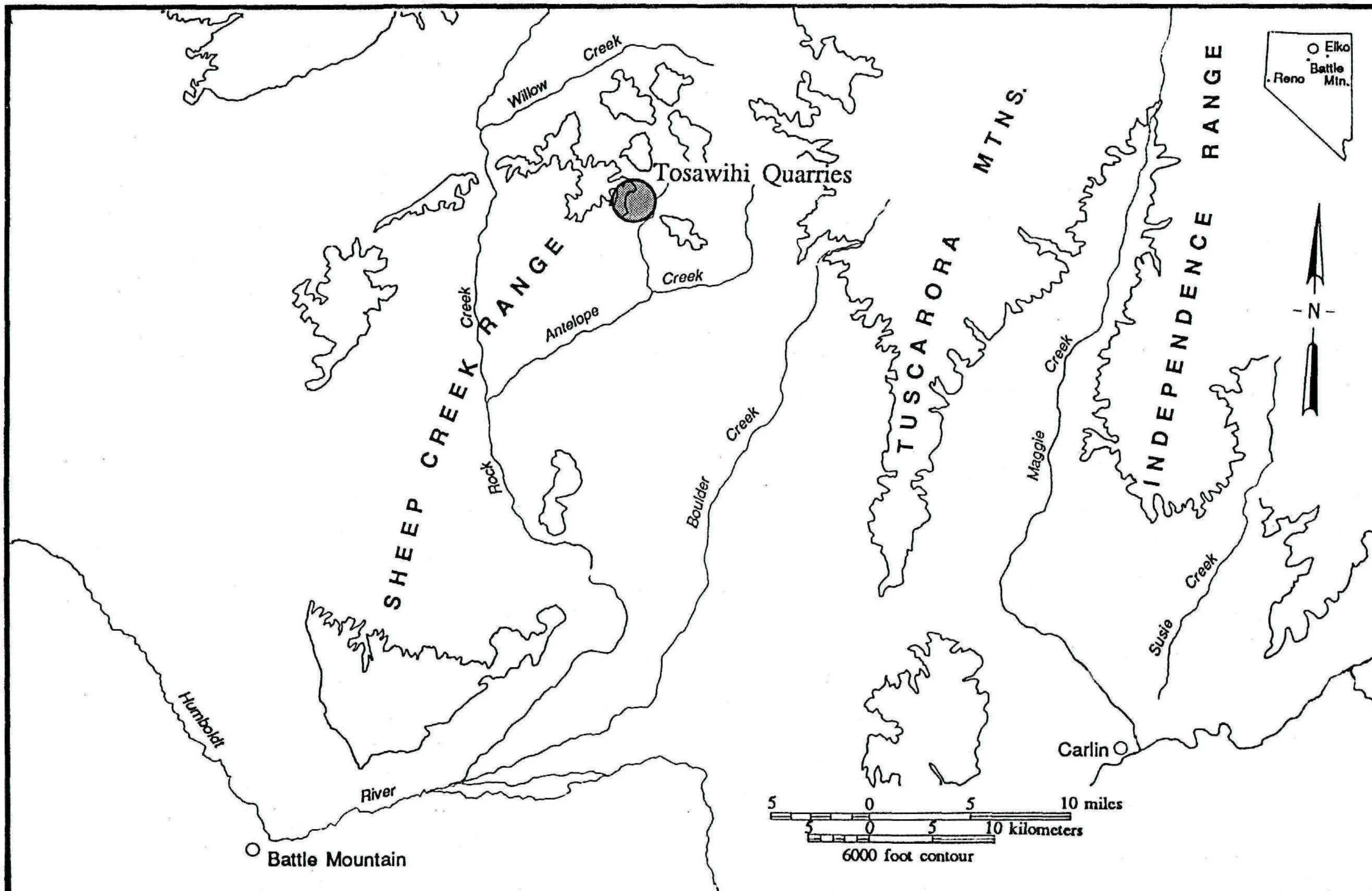

Figure 1. Regional map.

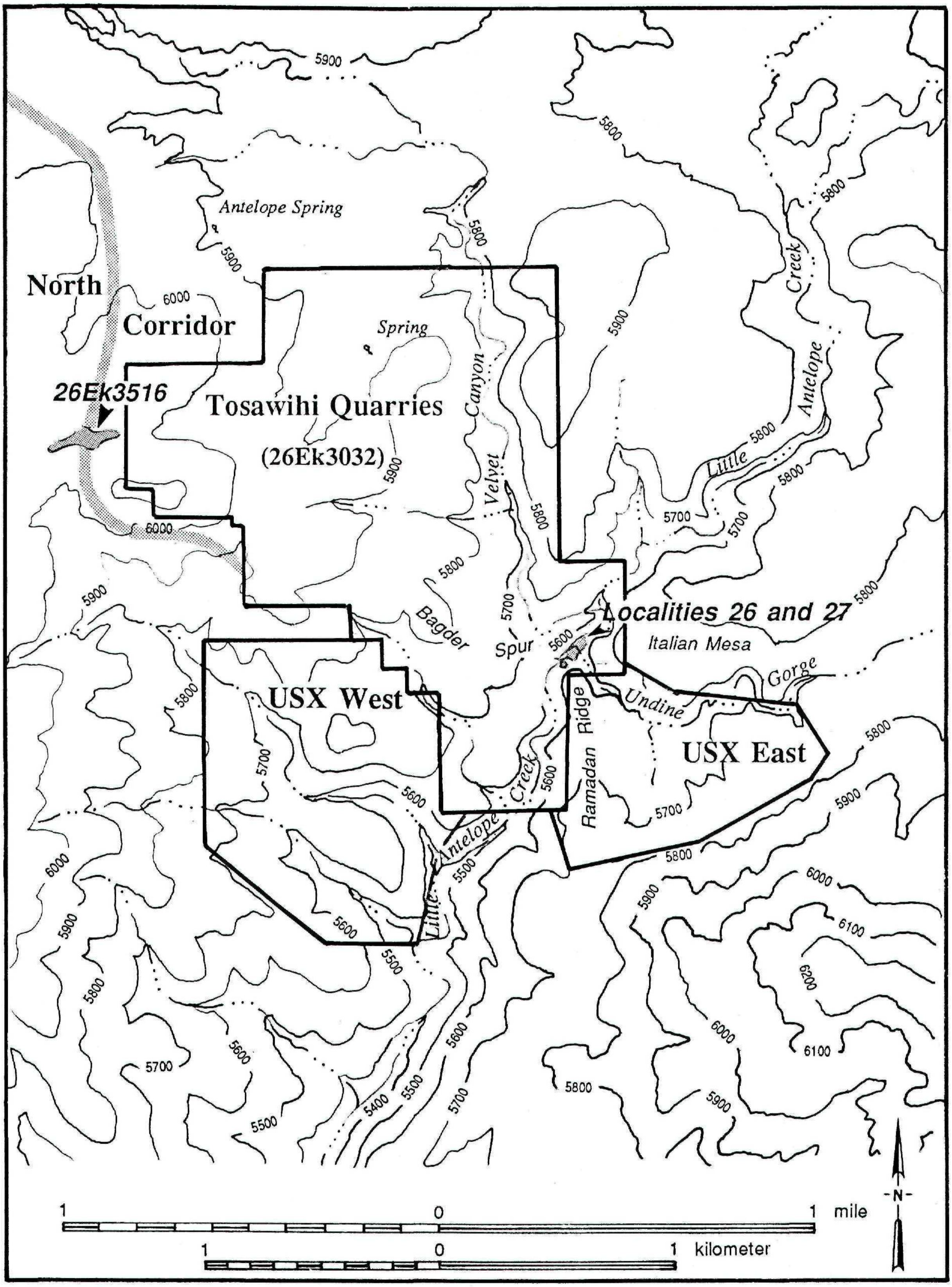

Figure 2. Study area map.

Chapter 2

DESCRIPTION OF LOCALITIES 26 AND 27

The Localities 26, 27 study area represents a small northward expansion of the USX-East Project Area and, as such, falls entirely within the Tosawihi Quarries site, 26Ek3032 (Figures 3, 4; cf. Elston 1989). Specific information regarding the physical setting and archaeological content of these areas is available in numerous previous accounts of Tosawihi focused research (i.e., Elston, Raven, and Budy 1987; Intermountain Research 1988a, 1988b; Elston 1989; Elston and Raven 1991). Our most comprehensive and, to date, most highly evolved understanding of the interplay of Tosawihi landscape and prehistoric land use is offered by Raven (1991a). Botkin, Dugas, and Elston (1991) describe the archaeological content of the USX-East project area and adjoining portions of the Quarry proper. Here, only details pertinent to the study area itself are addressed.

Physical Setting

The study area occupies an irregularly shaped parcel of 8.5 acres along a short reach of Little Antelope Canyon between the northern terminus of Ramadan Ridge and the southern footslopes of Badger Spur (Figure 3). The northern two-thirds of the area encompasses Big Meadows, a broad, grassy system of stream terraces surrounding the confluence of Little Antelope Creek and the drainage of Undine Gorge. Elevated from ca. 0.5 m to 3 m above the active streambed at the confluence (5560 feet [1695 m] amsl), Big Meadows is relatively flat, is mildly dissected by a series of abandoned channels, and is open in aspect. The steep colluvial slopes of Badger Spur and talus cones buttressing Italian Mesa impinge on Big Meadows along the west and east, respectively; their toeslopes constitute the boundaries of the study area in these quarters. The southern portion of the study area subsumes the lowest, northernmost extent of Ramadan Ridge where it coalesces with the stream terraces of Big Meadows (Figure 5).

Several physical attributes conducive to human occupation coincide in the study area and likely conditioned aboriginal use of the place. In terms of its provision of water, the study area is more favorably endowed than virtually any other location in the eastern periphery of the Tosawihi Quarry. For part of the year at least, surface water is available essentially "on-site". One of the only two springs that emerge in the Quarry rises within Big Meadows at the foot of Badger Spur. As well, Antelope Creek and Undine Gorge channel copious flows during spring runoff and deep intermittent pools persist along the streambeds until late June.

The riparian location of the study area positions it on the most direct foot-route between the Tosawihi Quarries and ethnographic White Knife Shoshone winter villages on the Humboldt River. For people traveling the system of watercourses that link these two locations, the relatively well watered flats of Big Meadows offer one of the first (or last) places suitable for residential bases close to the quarry area (Elston, Raven, and Budy 1987:40).

Prior to the middle of the last century, we suspect that by local standards, the study area constituted a comparatively rich foraging patch for its offering of productive riparian plant species and the game attracted to them (cf. Raven 1991a). Today, with the spring developed for livestock use, cattle that congregate there have rendered the vegetation of Big Meadows a sparse cover of cheat grass dotted by isolated clumps of Great Basin Wild Rye and tall sagebrush. Sporadic growths of sedge and wild rose occur along the stream bottoms. Higher on the slopes vegetation is similar to that found elsewhere in the vicinity. Ramadan Ridge and adjacent upland contexts support a non-nutritious mosaic open stand of tall and low sagebrush accompanied by rabbitbrush, phlox, and sparse grasses.

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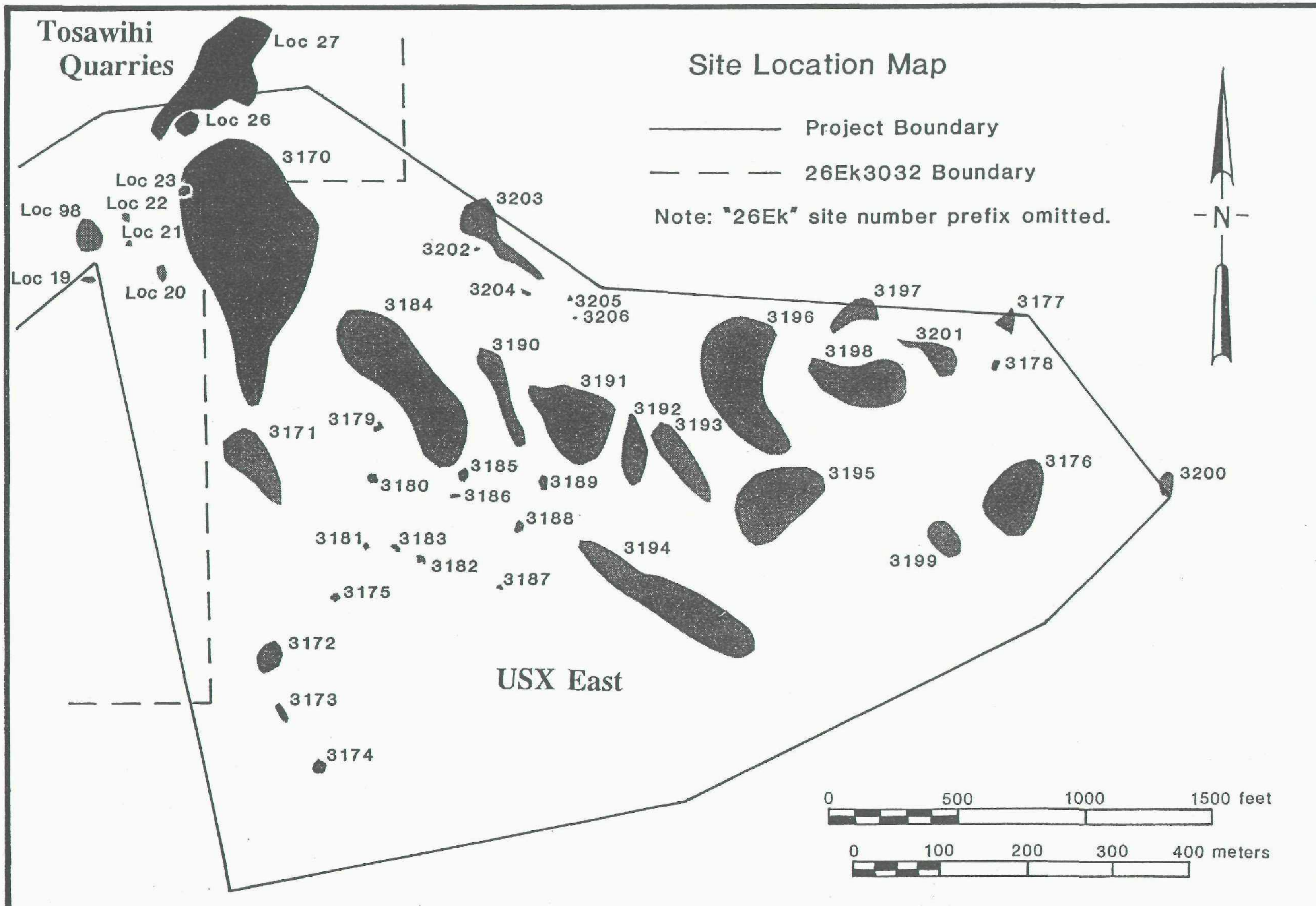

Figure 4. USX-East, site location map.

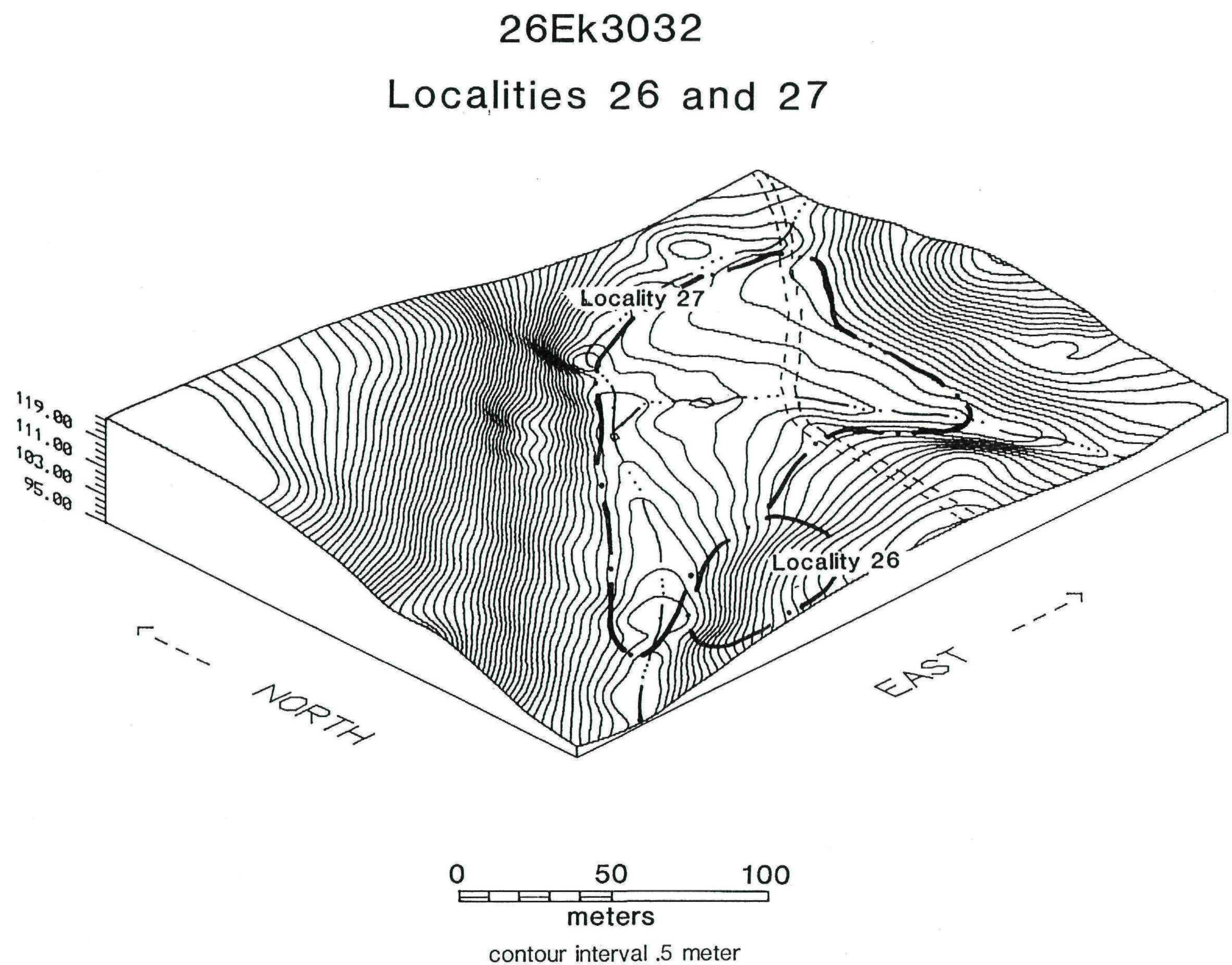

Figure 5. Topographic setting of 26Ek3032, Localities 26 and 27.

Toolstone sources are comparatively meager within the study area proper. They are restricted to the near surface bedrock supplies along the highest stream terrace on Ramadan Ridge (Locality 26) and to the opalite cobbles that bottom the streambeds of Undine Gorge and Little Antelope Creek (Locality 27). The location of the study area does, however, position it central to numerous lithic sources close by. The nearest of these, seven quarry pits defining Locality 29, lie perched on the crest of Badger Spur just 80 m north of the study area. Immediately beyond these occur the extensive quarry pit complexes in the heart of the Tosawihi Quarries. As well, opalite toolstone is available close at hand within several sites in the USX-East project area, all of them accessible via the easily navigated terrain southeast of the study area (cf. Elston, Raven, and Budy 1987:38; Botkin, Dugas, and Elston 1991; Raven 1991b).

Geologic and Geomorphic Setting

Components of surficial deposits within the study area include alluvial deposits from Little Antelope Creek and Undine Gorge, associated colluvial materials from adjacent slopes, silts and ash of eolian origin, and debris from cultural activities (quarrying).

The beds of the currently active channels are entrenched to about 1 meter below the meadow surface and contain, along with gravels and coarse sands to silt, rounded to subangular boulders and cobbles composed of reworked older alluvial deposits, and colluvial debris from adjacent slopes where products of relatively recent weathering of the various bedrock types, including opalite, are being introduced into the system. These two drainages are responsible for a series of active and abandoned channels, and interrelated surface and subsurface terrace features in the site area. These will be discussed in more detail later.

Bedrock geology in this region of Elko County is dominated by mid-Tertiary age volcanics. These are primarily phenorhyolitic to phenodacitic ignimbrites produced by the eruption of hot debris-charged gas clouds or they are exogenous domes and flows of porphyritic phenorhyolitic and phenodacitic rocks (Coats 1987). Alkali olivine basalts are present in significant amounts. In the immediate site area rocks that underlie the meadow and comprise the ridges west and south of the meadow commonly are opalized, massive airfall and ashflow tuffs, and reworked tuffaceous sediments with Valmy Quartzite and chert clasts in a silicified matrix. Ramadan Ridge, which separates the drainages of Little Antelope and Undine Creeks, is composed of massive to flowbanded, ignimbritic rhyolite with quartz phenocrysts. These are capped by opalized tuffaceous sediments (Bailey and Phoenix 1944; Granger et al. 1957; Cornucopia 1987). Opalization of bedrock and the resultant occurrence of toolstone is an important aspect of the geology in this area.

The present structural character of the rocks in this area is predominately the result of Tertiary to recent normal faulting, typical of the Great Basin. The regional dip is about 30° to the southeast.

Site Descriptions

Localities 26 and 27 constitute two adjacent but functionally distinct prehistoric activity areas: Locality 26, a small quarry pit complex; and Locality 27, an open residential locality. Both are components of the Big Meadows Archaeological Neighborhood of site 26Ek3032 (see Figure 3) and were recorded originally during intensive survey of the Tosawihi Quarry (Elston, Raven, and Budy 1987).

Locality 26

Locality 26 is manifest on the surface by three close-set quarry pit depressions centered on a microtopographic flat provided by an ancient stream terrace along the western flank of Ramadan Ridge (Figure 6). Elevated some 7 m higher than the current bed of Little Antelope Creek, the pit berms coalesce to create an anthropic talus of quarry debris that extends downslope onto the southern edge of Big Meadows, covering the original ground surface up to a meter deep.

The cultural content of Locality 26 suggests that it served almost exclusively as a source of good quality toolstone. Throughout its 1900 m^2 extent, the locality is paved with a dense accumulation of opalite debitage and biface fragments. Virtually the entire artifact collection obtained by testing is directly referable to toolstone extraction and early through intermediate stage processing tasks.

Locality 26 remained essentially undisturbed by historic impacts prior to our tests. Colluvial redeposition has altered original site contexts. The large, clastic quarry debris seems to have proven unattractive or impenetrable to burrowing animals.

Locality 27

Locality 27 is defined by a moderate density lithic scatter that covers 11,000 m^2. Its boundaries are congruent with the entire expanse of Big Meadows south of Badger Spur (see Figure 6). Little Antelope Creek flows through the western portion of the locality. The seasonal stream that drains Undine Gorge roughly bisects the locality east to west en route to its confluence with Little Antelope Creek at the western edge of the site. The steep slopes of Badger Spur and Italian Mesa tangent Locality 27 on the west and east, respectively. On the north, Locality 27 is differentiated arbitrarily from an apparently similar locality by a segment of Little Antelope Creek. On the south, Locality 26 and Locality 27 share a common boundary for a distance of ca. 40 m along the slopes of Ramadan Ridge where opalite debris derived from the quarry pits at Locality 26 merges with the surface lithic scatter of Locality 27.

The topography of Locality 27 is largely the product of the downcutting and filling accomplished by Little Antelope Creek and Undine Gorge (see Figure 5). The ground surface is generally flat; subtle undulation has been imparted by a network of inactive drainage channels and a series of stream terraces. Soils vary considerably across the site and include alluvial deposits from the creeks, colluvial materials from the surrounding slopes, as well as contributions of eolian silts and ash.

The surface lithic scatter is dominated by debris from opalite processing accompanied by a high incidence of maintenance/subsistence tools. Absent the discernible concentrations of artifacts commonly encountered as cultural features at most other sites in the vicinity, the scatter litters the surface in amorphous fashion throughout its extent. Unlike the exclusively surficial nature of most Tosawihi sites however, the scatter at Locality 27 overlies subsurface deposits of similar cultural content augmented by ceramics and non-utilitarian artifacts to depths of over 1 m.

Natural and human induced disturbances have affected Locality 27. However, it appears for the most part to remain well preserved. A modern dirt road transects its eastern quarter and a scatter of recent and historic debris throughout its northern portion attests to casual intermittent use up through the present time. Cattle grazing and its attendant trampling and exacerbation of erosion is locally intensive. Natural post-depositional processes effecting the integrity of Locality 27 are comparable to those observed at sites throughout the Tosawihi vicinity (Elston and Dugas 1991). Turnover by rodent and badger burrowing is pronounced, and flooding and migration of drainage channels undoubtedly have altered deposits.

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Chapter 3

FIELD METHODS, LOCALITIES 26 AND 27

Field techniques at Localities 26 and 27 were designed to recover data appropriate to research questions we have identified for the larger Ivanhoe Project (Budy, Elston, and Raven 1989; Elston et al. 1991). Particular data retrieval strategies were tailored to the character of each locality—the primary toolstone source at Locality 26 and the residential and reduction deposits at Locality 27. Contour mapping, intensive surface reconnaissance, systematic surface collection, backhoe trenching, and judgmental and random sampling of major physiographic strata and depositional contexts were employed.

Locality 26

To illuminate the nature and extent of prehistoric quarrying activities at Locality 26 and to allow examination of the geomorphology of the setting, we excavated one backhoe trench (Figure 7) parallel to the slope, intersecting one of the quarry pits first identified during survey and exposing it to bedrock. Two additional subsurface quarry pits were exposed thereby. Details of the worked bedrock surfaces, quarry pit stratigraphy, and sediment profiles were recorded, and are discussed below. Sediment samples were collected and processed.

Upon completion of stratigraphic profiling in Trench 1 at Locality 26, quarry pit deposits were sampled systematically, resulting in the collection of 33 bulk lithic samples. Generally, trench sampling sought to chronicle the quarrying events responsible for the creation of Locality 26. Specifically, samples were obtained with the goal of illuminating quarry pit formation processes and temporal variation in the techniques of toolstone procurement and processing.

Lithic samples taken from Locality 26 were bulk samples of approximately 7 liters each, composed of all cultural and non-cultural lithics, soil matrix, organic debris, etc., that occurred within a given location on the trench sidewall. Using profile drawings and descriptions as a guide, at least one such sample was troweled from each of the stratigraphic units comprising the deposit.

Selection of the location for sampling within a stratigraphic unit was judgmental. Where a unit contained relatively homogeneous contents and was of limited horizontal dimension, a spot that appeared to be "representative" of the unit was chosen for sampling. Conversely, a unit displaying heterogeneity of composition was sampled along its horizontal extent to document this variability. Where units clearly represented fill within quarry pits, samples were taken from locations corresponding to bottom, slope, and berm of the deposit. To the extent that the texture of any given stratigraphic unit allowed, field workers attempted to restrict samples to as small and spatially discrete an area of the unit as possible in order to insure sampling only within that unit. In most instances, the desired 7 liter sample could be obtained by troweling a 50 cm by 30 cm niche some 20 cm deep into the sidewall.

In sampling several of the stratigraphic units, collection methods deviated from the approach just described. Where a unit occurred as a thin veneer in profile, extending only a few centimeters into the sidewall, it was necessary to collect a sample from a broad expanse of the unit in order to obtain the standard sample volume. Samples taken in this manner tended to homogenize diversity artificially within units. Also, some units proved too small in all dimensions to provide quantities of material sufficient for our standard volume. Here, we collected as much of the unit as possible, sometimes retrieving as little as 2 liters of deposit.

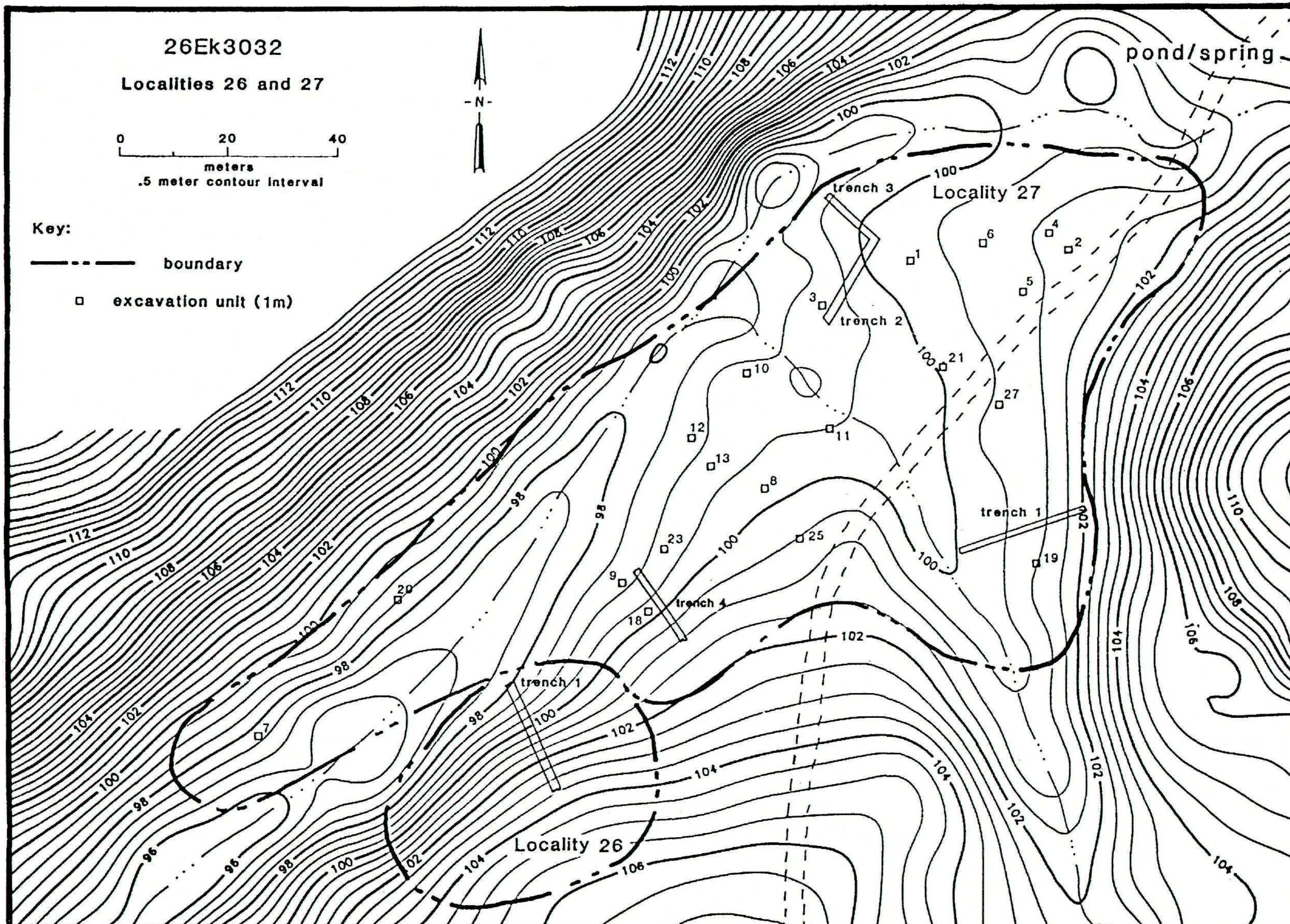

Figure 7. Location of backhoe trenches and excavation units, 26Ek3032, Localities 26 and 27.

After collection, the location and extent of each sample was plotted on the stratigraphic profile drawings. Field notes that recorded qualitative comments about the placement and content of samples, as well as any deviation from standard collection methods, were maintained throughout the exercise. Each sample was bagged separately and affixed with appropriate provenience data.

Post-field preparation of lithic samples was minimal. Each raw sample was weighed and then washed in 1/8 in. mesh trays. Only large root fragments and other recent organic debris were culled manually from the samples. Materials passing through the mesh consisted almost exclusively of the soil matrix, pulverized tuff, minuscule charcoal flecks, and opalite "hash" composed of minute shatter and flake fragments. After drying, samples again were weighed, then rebagged, ready for analysis.

Because the surface of the locality was paved with considerable quantities of debitage, shatter, cores, hammerstones, and bifaces, we undertook an intensive, systematic surface reconnaissance to locate and collect all formed artifacts.

Locality 27

To isolate potential surface cultural features, we first scrutinized the surface of the locality and mapped and collected all formed artifacts and obsidian debitage large enough for source characterization. In an attempt to expose potential buried features and identify the depth and complexity of deposits, we then excavated 20, 1 m x 1 m units placed to sample five topographic strata defined by stream cuts and depositional variability within the meadow/drainage system (see Figure 7). The locations of 18 excavation units were assigned at random within four sampling strata, and two units were placed judgmentally in the fifth to explore the low terrace southwest of the meadow and across Little Antelope Creek.

Excavation units were dug by 10 cm level, with soil and cultural material screened through 1/4 in. mesh. Artifacts (debitage, formed tools, ceramic sherds, and ornaments), excluding angular debris, were retained, bagged by provenience and processed. Two excavation units (EUs 4 and 8) served as control units, each containing a 50 cm x 50 cm quadrant which was screened through 1/8 in. mesh.

The 20 excavation units removed 4.6 m^3 of subsurface deposits. In most cases, excavation ceased upon encountering the impenetrable stream cobble substrate that underlies the alluvial soils of Big Meadows or the culturally sterile indurated red clay immediately above the cobbles.

Additionally, four backhoe trenches were excavated to examine details of past creek behavior, sedimentation history, and subsurface terrace features (see Figure 7). Stratigraphic profiles of selected portions of these trenches were drawn. These are discussed in the following chapter.

Chapter Four

TEST RESULTS, LOCALITIES 26 AND 27

Surface Reconnaissance and Collection, Locality 26

Surface collection of the extremely dense concentration of quarrying debris visible at Locality 26 yielded 80 formed artifacts and 3 obsidian flakes (one biface was recovered in the trench excavation). Bifaces dominate the surface assemblage, while hammerstones and cores make up a smaller proportion of the formal tools (Table 1). The assemblage at Locality 26 reflects a clear focus on toolstone extraction and early stage biface reduction.

Table 1. Summary of Formed Artifacts and Exotic Materials Recovered from 26Ek3032, Localities 26 and 27.

ARTIFACT TYPE	MATERIAL TYPE						
	Opalite	Obsidian	Basalt	Quartzite	Rhyolite	Other	Total
Locality 26							
Bifaces	59	-	-	-	-	-	59
Cores	5	-	-	-	-	-	5
Modified Chunks	2	-	-	-	-	-	2
Hammerstones	1	-	-	7	2	-	10
Abraders	-	-	-	-	2	-	2
Choppers	1	-	-	-	1	-	2
Flake Tools	1	-	-	-	-	-	1
Obsidian Flakes	-	3	-	-	-	-	3
TOTAL	69	3	0	7	5	0	84
Locality 27							
Projectile Points	5	3	-	-	-	-	8
Preforms	5	-	-	-	-	-	5
Bifaces	278	-	-	-	-	-	278
Flake Tools	34	4	-	-	-	-	38
Modified Chunks	19	-	-	-	-	-	19
Hammerstones	3	-	1	4	1	-	9
Choppers	-	-	-	-	-	-	0
Cores	13	1	-	-	-	-	14
Ground Stone	-	-	3	-	4	-	7
Pottery	-	-	-	-	-	11	11
Beads	-	-	-	-	-	2	2
Obsidian Flakes	-	38	-	-	-	-	38
Historical Items	-	-	-	-	-	92	92
TOTAL	357	46	4	4	5	105	521

Surface Reconnaissance and Collection, Locality 27

Intensive surface examination of Locality 27 encountered an abundant and diverse array of tools amid the moderate density scatter of opalite debitage that blankets the area. The 167 formed artifacts retrieved by the exercise comprise roughly half the entire assemblage from the locality and include, in addition to bifaces and other opalite processing-related forms, numerous flake tools and projectile points, and six of the seven groundstone implements in the collection (Appendix B).

Nowhere do cultural materials occur in concentrations sufficiently dense or well defined to be identified as the "Reduction Station" features that typify virtually all other sites in the vicinity (cf. Botkin, Dugas and Elston 1991). Instead, surface artifacts are scattered rather evenly across the alluvial flats of Big Meadows. Although three very broad, generalized "clusters" of formed artifacts are discernible within the distribution, these appear to be a fortuitous by-product of the partitioning of the site surface by Little Antelope and Undine Creeks, as well as by the meanders of the inactive channels that cross it. Several shallow depressions in the northern portion of the locus, that attracted attention for their apparent similarity to house depressions, proved instead to be stock wallows.

Excavation Units

The excavation of 20 EUs resulted in the recovery of 224 formed artifacts and copious quantities of lithic debitage. Testing revealed subsurface cultural deposits throughout the horizontal and vertical extent of the locus, averaging ca. 50 cm in depth. Excavation unit depths ranged from 20 cm in the central portion of the locus adjacent Undine Creek to 140 cm along the low bench on the west bank of Little Antelope Creek (EUs 7 and 20) and just east near the base of Ramadan Ridge (EU 9). Except for the lack of groundstone implements, the subsurface assemblage mirrors the content and diversity of that encountered on the surface, and includes, as well, numerous ceramic sherds and two beads.

Although excavations failed to disclose unequivocally the presence of subsurface cultural features, returns from several probes in the south-central and northern quarters of the locus hint at their existence. In EU 9, subsurface finds reflect an increase in the diversity (which includes flake tools, pottery, and groundstone) and density of artifact classes and debitage over surface finds. In EU 1, several small charcoal lenses amid an amorphous zone of diffuse carbon-stained soil and angular clasts within level 3 may represent the remains of a poorly preserved hearth. Its highly turbated state and the local history of recurrent range fires prevent confident identification of a cultural feature.

Excavations in the northeastern quarter of the locus reveal a pronounced concentration of opalite debitage and artifacts at depths of between 20 and 30 cm. The concentration was encountered over an area ca. 20 m in diameter sampled by EUs 1, 2, 4, 5, and 6, and in the case of EU 6, occurs in sufficient density to be discernible in the sidewall. In EU 1, five scraping tools were distributed over the first three levels. The composition and extent of the concentration suggests that it is a buried living surface or special activity area, similar to subsurface features explored at 26Ek3092 in USX-West (Leach, Dugas and Elston 1991), and at Feature 1 at 26Ek3192 in USX-East (Botkin, Dugas and Elston 1991).

Debitage is more widely distributed, achieving its highest densities in the northern half of the site (EUs 1, 2, 5, 6, 9, 19, and 27). Too, there are portions of the site surface which reflect highest debitage densities in the upper 2 cm of deposit, while other areas of the site reveal significant increases in density below surface (discussed below).

The horizontal and vertical clustering of artifacts at Locality 27 suggests clear potential for examining the spatial segregation of prehistoric activities in a chronological framework. The northeast sector of the site, in particular, may have been the focus of residential activities, while opalite processing and biface manufacture were more broadly distributed.

Stratigraphic Analyses

This section details several analyses conducted after the placement of backhoe trenches through the westernmost quarry pit depression visible on the surface of Locality 26, and through terrace deposits at Locality 27. The first part of the discussion describes the general nature of deposits produced by prehistoric quarrying activities (and defines key terms) as a backdrop for the technical observations made on the stratigraphic profiles that follow.

Quarrying Activities and Resulting Deposits

Deposits produced by quarrying activities and recognized in backhoe trenches can be grouped into general categories relating to the probable method used to extract toolstone (Dugas 1991). For instance, two typical fill types attributed to quarrying are lenses of coarse opalite chunks and flakes, and lenses of very fine opalite chips mixed with silts and pulverized tuff. The term "chunks" describes generally angular opalite or tuff clasts of various sizes that are not considered flakes. "Chips" refers to opalite pieces that are generally finer (2 mm - 3 cm) than chunks and appear to be products of early stage quarrying rather than reduction debris. "Flakes" are pieces produced by toolstone reduction.

Initially, quarrying began by the removal of soil and colluvial cover from the bedrock that, typically, is a combination of tuff and irregular patches and bands of opalite. Once bedrock was exposed, quarrying entailed attempts to remove tuff and poor quality opalite from around usable opalite. This operation apparently was accomplished in part by battering the bedrock with other stones, usually stream cobbles. Products of this activity are likely to be deposits of angular opalite and tuff chunks, mixtures of opalite chips, chunks, and soil from the pit margins, and abundant fine chips of opalite and pulverized tuff, termed "hash". Experiments in creating a quarry pit, using a battering technique, produced such materials (Carambelas and Raven 1991). Battering of the bedrock at the bottom of the pit, in order to remove surrounding tuff or to create cracks that might be used to wedge out pieces, was probably one of the first stages of quarrying. Hash debris is likely to be one of the initial units deposited as pit fill.

Another type of quarry debris, resulting from the reduction of large pieces of opalite to smaller usable pieces, consists of very distinct lenses of medium to coarse, open framework opalite chunks and flakes. "Open framework" refers to deposits in which coarse pieces of rock are lying against or on one another, with abundant open spaces between pieces. This also is referred to as a clast-supported deposit. These units are divided into poor, moderate, or typical open frameworks, depending on the relative amount of void space and matrix present. When the matrix is abundant, and the larger pieces do not rest on one another, it is described as a matrix-supported deposit.

During the stage of quarrying that produced open frameworks, larger flakes and chunks either were dropped to the bottom and sides of the pit to form subhorizontal layers or they were pushed back out of the way as quarrying resumed, resulting in a deposit that is a randomly piled, jumbled mass of clast-supported materials. Typically, this coarser material is accompanied by a sparse matrix of sandy to clayey silt with fine chips of opalite and tuff. This matrix was incorporated into the deposit either by mixing when the clasts were pushed out of the way or by later infiltration of fine material into the open framework.

Although quarrying produced abundant fill episodes, there were gaps in quarrying activity, during which colluvial slopewash and eolian materials were deposited in the pits. Colluvial slopewash constitutes the downslope movement of sediments caused by periodic rains and/or gravity. At Locality 26, slopewash deposits commonly are dominated by a silty matrix, with matrix-supported subrounded pebbles, opalite chunks, chips and flakes, and tuff chunks.

Commonly, later stage reduction debris is present as lenses in this silty material, particularly in units near the surface. This probably results from periodic episodes of toolstone reduction in areas peripheral to the center of the active quarry pit. It is also probable that, like some of the open framework episodes mentioned above, some finer pit fill episodes have been redeposited. The need to reach bedrock for subsequent quarrying would have made it necessary to scoop overlying materials out of the way. Such redeposited units are suggested by a jumbled appearance, with most of the opalite flakes present being matrix-supported in non-horizontal orientations. These are, however, generally difficult to discern from undisturbed slopewash units.

The mixture of quarry debris, thrown out of the pit or washed down from the area around the pit edge, and sediments from natural slopewash processes that were deposited as colluvial talus outside the quarry pits, comprises another general category of deposits commonly seen in backhoe trenches. In the quarry pits at Locality 26, these are predominantly brown to yellowish brown silt loams to clay loams, commonly with matrix-supported subrounded pebbles, subangular tuff and opalite chunks, and opalite flakes. These deposits grade into those of primarily alluvial origin within the meadow. Finally, all the deposits are mantled by eolian silts that comprise much of the current soil surface.

Locality 26: Backhoe Trench 1

The following discussion of the backhoe trench profile at Locality 26 identifies stratigraphic units representative of the types of deposits described above, and also those associated with alluvial activity in the site area.

Backhoe Trench 1, placed on an approximate NNW line through the quarry area (see Figure 7), provides a profile of quarry pits 1 - 3, a downslope accumulation of slopewash and quarry debris forming a colluvial talus, and finally, mixed deposits of slopewash and alluvium. The resulting sidewall profile revealed an 18 m long section of complex, stratified deposits with nearly 7.5 m of total relief (Figure 8).

The onlapping of depositional units from the backfill of one quarry pit over those of another suggests that the pits were worked in succession: the lowest northern-most pit first and the highest southern-most pit last. The fill from the northern-most pit (pit 3), for example, includes stratigraphic units 32 through at least unit 23 (Table 2). These are overlain by silty, predominately slopewash units such as 16 and 17. Note that unit 10 of the middle pit (pit 2) onlaps and truncates units 16 and 17, which in turn overlie units filling the northern pit. This effect also can be seen between the middle pit and the southern pit. There, unit 4 of the southern pit overlies unit 5, which in turn overlies units in the middle pit.

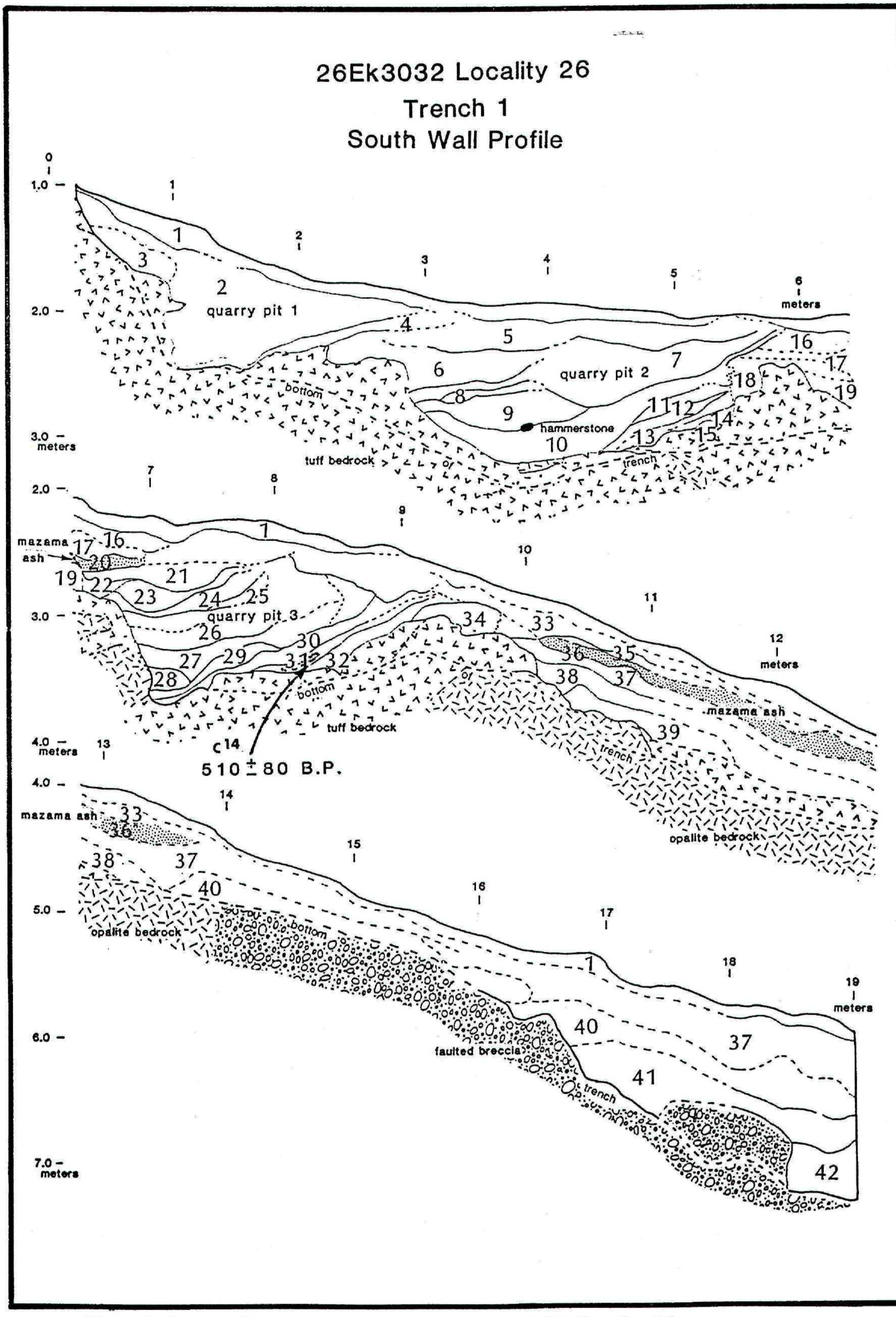

Figure 8. Backhoe Trench 1, south wall profile, 26Ek3032, Locality 26.

Table 2. Description of Stratigraphic Units, Southwest Wall of Trench 1 at 26EK3032, Locality 26.

Stratum	Description
1	Brown (10YR 5/3 dry) silt loam; weak to moderate, very fine granular; abundant fine to medium roots, abundant dry organics at surface; common opalite and tuff chunks and flakes.
2	Light brownish grey (10YR 6/2 dry) and brown (7.5 YR 5/4 dry) mottled, clay silt loam to silt loam; moderate, fine to medium crumb; common fine to medium roots; common fine pores; common opalite chunks and flakes, fairly common tuff clast, all scattered randomly except for a few vague subhorizontal flake lenses. The "reddish" mottling in this unit is more common to the southeast.
3	Brown to dark brown (7.5YR 5/4 to 4/4 dry) sandy clay loam to sandy clay; strong, fine to medium subangular blocky; common fine to medium roots; common to abundant medium to large subangular tuff cobbles with clayey soil matrix thinly separating the clasts. This is the weathered upper portion of the tuff bedrock. There was no cultural quarry debris evident.
4	Pink (7YR 7/4 dry) tuff sand "hash"; varies in texture and inclusions across unit, ranging from a tuff "hash" to slightly open framework tuff clasts with tuff sand matrix, but has the same distinct color throughout.
5	Brown (10YR 5/3 dry) silt loam; weak to moderate, fine to medium granular; common medium roots. This unit has a rubbly appearance with common fine to medium angular to subangular tuff clasts and common fine to medium opalite flakes and chunks.
6	This unit was similar to unit 5 but contains noticeably fewer of the larger clasts of tuff and opalite.
7	Brownish, mostly clast-supported medium to coarse subangular to subrounded tuff chunks and white to pink opalite chunks and flakes in a moderate amount of matrix of coarse tuff sand and brown (10YR 5/3 dry) silt loam.
8	Brown (10YR 5/3) silt loam; weak to moderate, fine granular; common fine roots and pores; rare fine opalite and tuff pieces.
9	Brownish open framework of medium to coarse subangular to subrounded tuff and opalite flakes, chunks, and chips. The matrix is a fairly sparse brown (10YR 5/3) silt loam.
10	Light brown (7.5 YR 6/4 dry) tuff "hash", composed of abundant fine to medium subangular tuff clasts and very fine to medium pink opalite flakes and chips.
11	Light brownish grey (10YR 6/2 dry) silt loam; weak to moderate, fine to medium granular; common fine roots and pores; rare subangular tuff clasts and opalite flakes.
12	Light brown (7.5 YR 6/4 dry) medium to coarse tuff sand mixed with light brown silt loam; abundant fine subangular to subrounded tuff pebbles and common fine pink to white opalite chips and flakes.
13	Brown (7.5 YR 5/4 slightly moist) fine to medium sand with sandy clay patches, clay with fine to medium subangular blocky structure; well consolidated; common to abundant fine to medium tuff and opalite clasts.
14	Moderate open framework of orangish to pink subangular tuff chunks, with pink to white very fine to slightly coarse chips, chunks and flakes. There is a fairly common brown (7.5YR 5/4 slightly moist) clayey sand matrix.
15	Yellowish brown (7.5YR 5/4 dry) and brown (7.5YR 5/4 dry) mottled loam and silty clay loam, respectively; clayey patches with moderate fine blocky structure; common medium opalite and tuff clasts. This unit is mixed with weathered tuff bedrock along its base.
16	Pale brown (10YR 6/3 dry) loam to sandy loam; loose to weak fine granular; abundant fine and medium roots. Fine to coarse opalite and tuff flakes and chunks are common and have a rubbly appearance similar to unit 5.
17	Yellowish brown to dark brown (10YR 5/4 to 4/4 slightly moist) silt loam to clay loam; weak to moderate fine granular to fine subangular blocky; common fine to medium roots; rare to common fine to medium tuff clasts and opalite flakes.
18	Brown (7.5YR 5/4 slightly moist) clay loam; moderate, fine subangular blocky; rare to common fine to medium roots; rare to common fine tuff and opalite clasts.
19	Strong brown (7.5YR 4/6 slightly moist) clay to silty clay; moderate to strong,fine subangular blocky; common fine roots between peds; common to abundant, coarse sand size tuff clasts and opalite chips. This unit grades down to weathered tuff bedrock where it contains coarse to very coarse angular to subangular tuff clasts loosened from the bedrock.
20	Brown (10YR 5/3 dry) silt loam; moderate, fine granular; common fine roots; rare tuff pebbles and opalite chips. This unit contains dirty Mazama ash (see unit 36).
21	Brown (10YR 5/3 dry) and dark brown (7.5YR 5/4 to 4/4 dry) mottled loam and silty clay loam, respectively; moderate, fine granular; common to abundant, fine to medium roots; common to abundant fine to coarse opalite flakes and subangular tuff clasts, in some areas forming slightly open frameworks that have subhorizontally-lying, coarse opalite flakes forming vague lenses.
22	Brown (10YR 5/3 dry) silt loam; moderate, fine granular; common coarse sand size tuff pebbles and opalite chips.
23	Open framework of pink to white opalite flakes, chunks, and chips (very fine to very coarse) with some subangular fine to medium tuff chunks. many of the flakes are thin reduction or thinning flakes and commonly lie subhorizontally. The matrix consists of fairly sparse very fine opalite chips, fine tuff sand, and loam (brown 10YR 5/3 dry).
24	Brown (10YR 5/3 dry) and brown (7.5YR 5/4 dry) mottled silt loam and silty clay, respectively; moderate, fine granular to fine subangular blocky; common fine and medium roots; common fine to medium opalite flakes and chunks and tuff clasts.
25	Moderate open framework of medium to coarse subangular chunks of tuff and rare flakes and chunks of opalite; becomes more coarse and open to the northwest; There is a moderate amount of matrix of brown (10YR 5/3 dry) silt loam.

Table 2, continued.

Stratum	Description
26	Highly banded unit of silt loam to silty clay loam to coarse tuff sand that becomes a moderate open framework to the northwest. Clasts vary from very fine opalite chip, and finer to medium subrounded tuff pebbles, to very coarse opalite chunks and flakes, and coarse subangular tuff cobbles.
27	Predominately an open framework of medium to coarse subangular tuff clasts, with a moderate amount of matrix consisting of brown to yellowish brown (10YR 5/3 to 5/4 dry) loam with coarse tuff sand and very fine opalite chips.
28	Moderate open framework of medium opalite and tuff clasts in a moderate amount of sandy (tuff) loam (yellowish brown 5/4 dry) matrix.
29	Brown (10YR 5/3 dry) silt loam, moderate, fine granular; with mottles and discontinuous bands of strong brown (7.5YR 4/6 dry) sandy clay, very fine subangular blocky; rare fine roots; common fine pores; rare to common fine opalite flakes and tuff clasts.
30	Pale brown (10YR 6/3 dry) silty tuff "hash" with abundant very fine tuff chips to medium chunks, and abundant pink to white, very fine to medium opalite chips and flakes.
31	Brown (10YR 5/3 dry) loam to silt loam; common fine opalite chips and pebbles with rarer coarse clasts of tuff and opalite; some charcoal flecking present.
32	Open framework of medium opalite chunks, with less common medium opalite flakes and subangular tuff chunks. The sparse matrix is brown (10YR5/3 dry) silt loam with common tuff sand and rare small chunks and flecks of charcoal.
33	Brown to dark brown (10YR 4/3 dry) to brown (7.5YR 5/4 dry) sandy clay loam; moderate, fine granular to very fine subangular blocky; abundant fine to medium roots; fairly common fine clasts of subrounded to subangular tuff, with rarer fine opalite chunks and flakes. Contact with unit 1 is very indistinct.
34	Brown (10YR 5/3 dry) silt loam; moderate, fine granular to weak, fine subangular blocky; common fine to medium roots and pores; common fine to medium angular to subangular tuff and opalite chunks, and rare fine opalite flakes.
35	Light brownish grey (10YR 6/2 dry) silt loam; weak, very thin platy to very fine granular; common to abundant fine roots; rare fine to medium subangular tuff clasts and fine opalite flakes.
36	Brown (10YR 5/3 dry) silt loam; moderate, fine granular to weak, fine subangular blocky; common fine roots and pores; rare to common fine to medium opalite flakes and tuff clasts. This unit also appeared somewhat ashy and it is feasible that it is equivalent to the ashy unit 20.
37	Light yellowish brown (10YR 6/4 dry) silt loam; moderate, fine granular to weak subangular blocky; common fine and rare medium roots; common fine subrounded to subangular tuff clasts, and common fine white, or rare pink opalite chunks and flakes.
38	Yellowish brown (10YR 5/4 dry) clay loam; moderate to strong, fine to medium subangular blocky; rare to common fine to medium roots; common fine subrounded to subangular tuff clasts and opalite flakes and chunks.
39	Strong brown (7.5 YR 4/6 slightly moist) sandy clay; strong, very fine subangular blocky, weak clay skins on some ped surfaces; rare fine roots; abundant fine angular to subangular tuff and opalite clasts, and common large clasts of weathered opalite and tuff bedrock. Sandy clay from this unit has filtered down into cracks of the more intact weathered bedrock below.
40	Light yellowish brown (10YR 6/4 dry) to brown (10YR 5/3 dry) mottled silt loam; moderate, fine granular to weak, very fine subangular blocky, well compacted; rare fine roots, common fine to medium pores; rare to common subangular to subrounded tuff clasts and opalite flakes. This unit is has fewer tuff and opalite clasts to the southeast, and it becomes more mottled with brown silt to the northwest.
41	Brown (10YR 5/3 dry) clay loam; moderate to strong, fine subangular blocky, well compacted; rare fine roots, common fine and medium pores; common to abundant medium to coarse subangular tuff clasts and opalite chunks, rare medium opalite flakes.
42	Dark brown (7.5YR 3/4 slightly moist) sandy clay; strong, fine to medium subangular blocky, weak clay skins on a few ped faces, very well consolidated; common to abundant coarse to very coarse, opalite and tuff clasts. There are no cultural quarry debris apparent in this unit.

Within any particular quarry pit, fill deposits tend to alternate between coarser opalite debris, fine opalite chips mixed with pulverized tuffs, or fine silt dominated units, as discussed in the previous section. This variation reflects periods of quarrying followed by periods where natural depositional processes dominated. The northern pit provides a good example of such series of events.

If, as we believe, hash is the initial debris produced in the course of pit refilling, it should be among the lowest stratigraphic units present. In pit 3 of Trench 1 this is illustrated well by units 32, 31 and 30, which lie along the base of the pit, beginning at its lowest point. Unit 30 is a typical example of hash. Following the deposition of unit 30, a slopewash dominated episode occurred that produced unit 29. This is also true of unit 24.

Overlying unit 29 is a series of units, 28-25, which are typical of the coarse deposits produced during initial reduction of larger opalite pieces. Medium to coarse tuff and opalite chunks and flakes are the common constituents of these units. These are open framework clast-supported matrices with large voids.

Within pit 2, open framework units are represented by units 7, 9, 12, 14, and parts of 10. Hash episodes are represented by unit 12 and parts of 10. Unit 10 has elements of both types of material. Units 5, 6, 8, and 11 are fine slopewash episodes. It is possible that units 5 and 6 are reworked backfill from the upslope pit.

In pit 3, the southernmost pit, unit 4 is a combination of fine hash and coarse open framework material, somewhat similar to unit 10 in pit 2. Unit 2 is an interesting combination of fine silts and opalite and tuff clasts, some of which denote vague lenses. The structure of this unit, as compared to other fill episodes, may be the result of the reworking of some quarry debris and flakes in combination with a significant slopewash component readily provided to this highest pit.

Filling in these pits appears to have progressed through various phases until quarrying ceased and natural slope processes predominated or an episode of re-excavation occurred. Evidence of such re-excavation into previous pit fill is fairly common at other sites in the Tosawihi area, but, based on available evidence here, is limited at this quarry site. A possible example of re-excavation within Trench 1 is shown in the truncation of units 22-27 and 30 by the excavation that later was filled by unit 21.

As mentioned previously, another characteristic group of deposits are those making up the colluvial talus and associated alluvial and eolian deposits found outside the pits. These are typically on the downslope side of the pit in the case of Trench 1, where units 1 and 33-38 are part of the colluvial debris. Unit 36 in this sequence and unit 20 are notable for their ashy appearance and similarity to ashy units seen in hand and backhoe excavations at Locality 27.

Continuing downslope, the remaining talus materials become generally finer and pinch out or grade into alluvial units of the southwestern edge of the meadow. Below the main accumulation of colluvium, the sandy clay of unit 39 sits on weathered bedrock. This may represent remnants of a clay-rich red paleosol that appears in other profiles at nearby sites. This paleosol is probably of Pleistocene age, as it lies below the silty ash of unit 36. The stratigraphic relationship among all these deposits is simple, with their dips running parallel to the slope, as opposed to the deposits within the pits that dip into the slope.

The profile at the northwestern end of the trench shows silt loams, units 1, 37 and 40, overlying a clay loam and sandy clay, units 41 and 42. These lower clayey units may be part of a terrace feature, with their sand content the result of alluvial deposition and their clays an indication of their relatively older age. In addition to possible alluvial terrace sediments in this trench, indications of strath terraces (cut into bedrock) also were seen. Notable topographic breaks in the bedrock profile, between 15 and 18 meters along this trench profile, may be the product of alluvial cutting. This bedrock material is actually an accumulation of fine to medium angular gravels and fine to coarse sands that are strongly silicified. This is possibly a breccia associated with faulting in the immediate area.

Tephra (volcanic ash) originating in the Mazama eruption of 6,800 years B.P. (Davis 1978; Appendix A, this report) was identified in Unit 20, and we assume the ashy appearance of Unit 36 is also due to the presence of Mazama tephra. However, a ^{14}C date (Beta-35573; see Appendix E) from charcoal in unit 31 (stratigraphically below Unit 20) returned a date of 510±80 B.P. This suggests two major possibilities. In both we assume that the colluvial deposits on the slope below pit 3 are largely intact, preserving Mazama ash (Unit 36) in its correct stratigraphic position. This in turn suggests that, prior to the excavation of the quarry pits, the entire slope was stratigraphically similar with a buried stratum containing Mazama ash. One possibility is that Stratum 20 was excavated from the slope above during the creation of pit 2 and redeposited to its present location. Another possibility is that pit 3 was originally excavated prior to the deposition of Mazama ash, then abandoned, filled, and reexcavated about 500 years ago.

In any case, Unit 37, below Unit 36, contains flakes, possibly evidence of human activity older than 6800 B.P.

Locality 27: Backhoe Trench 1

Trench 1 was placed on an approximate ENE line, just east of where Undine Creek leaves Undine Gorge to flow across the meadow (see Figure 7). Trench 1 begins at the northeastern bank of the currently active channel of Undine Creek and continues to the foot of the colluvial slope to the northeast. The location of the trench was chosen to enable us to characterize sediments deposited by Undine Creek alone, with as little overprinting from Little Antelope Creek as possible. Also, trench placement was designed to facilitate study of any subsurface indications of terracing that might be related to surface terrace features which were observed in this immediate area. These appeared as a series of two to possibly four, very low relief, topographic breaks that ran parallel to the currently active channel and to an abandoned channel.

The deposits in the 24 meter length of Trench 1 can be described as a fairly thin layer of eolian silt loam soil overlying silty sands and gravels (Figure 9; Table 3). At the southwestern end of Trench 1 the stratigraphy is very simple, with a thin organic silt loam, unit 1, overlying unit 2, a sandy silt, which in turn overlies gravels of unit 3. Unit 3 is a dark brown to strong brown mixture of poorly sorted to vaguely lenticular, medium to coarse sands with clays and fine to very coarse, subrounded to subangular gravels and cobbles. An accumulation of carbonate was noted among these gravels at the northeastern-most end of the profile. Unit 3 was the lowest stratigraphic unit in the profile and was seen throughout the length of the trench and apparently extends under the colluvial materials at the northeastern end of the trench. This indicates that past stream activity here extended closer to the bedrock ridge than at present and that some sort of terrace feature may occur under the unexposed colluvial cover. The coarseness of the clasts in unit 3, and its wide lateral extent, suggests a higher flow regime for this drainage at some time in the past. As the stratigraphy was observed going northeastward in the trench, more units appear in the profile with the addition of unit 4, a silty ash underlying unit 2, and unit 6, a silty sand with gravels that underlies unit 4. Unit 5, which is transitional between units 4 and 6, can be recognized in places. Unit 4 was sampled for analysis and contains Mazama ash (Davis 1978; Appendix A).

Table 3. Description of Stratigraphic Units, Northwest Wall of Trench 1 at 26EK3032, Locality 27.

Stratum	Description
1	Greyish brown (10YR 5/2 dry) silt to silt loam; loose to weak platy, to weak, fine granular or weak, fine subangular blocky; common to abundant fine to medium roots, abundant dry organics near surface; common subangular to subrounded fine to medium gravels; boundary gradual and irregular.
2	Greyish brown to brown (10YR 5/2 to 5/3 dry) sandy silt loam; weak to moderate, granular to subangular blocky; rare fine to medium roots; common fine to medium subrounded to subangular gravels, rare fine to medium cobbles; boundary clear and irregular.
3	Dark brown (10YR 4/3 dry) to strong brown (7.5YR 4/6 dry) medium to coarse sand, with rarer fine sand, clays and fine gravels, all subangular to subrounded. This finer matrix surrounds common medium to very coarse gravels. There are some vague pebble lines present. There is a moderate carbonate accumulation as veins and weak coatings on larger clasts in this unit at the northeast end of the trench (see unit 8).
4	Pale brown to brown (10YR 6/3 to 5/3 dry) silty ash; rare fine and coarse subrounded gravels; boundary clear and very irregular. This unit has an ashy feel and forms a competent face but powders with relative ease. To the southwest this unit becomes siltier and is undiscernible from unit 2. This unit has been identified as Mazama tephra dated to 6,800 B.P.
5	Transition unit with characteristics of both units 4 and 6.
6	Dark greyish brown (10YR 4/2 dry) silty fine to medium sand, with common fine to medium subrounded to subangular gravels; boundary clear and irregular. This unit grades out of the profile to the southwest at about 12 meters and to the northeast at about 17 meters.
7	Brown (10YR 5/3 dry) silt loam; weak granular; rare fine to medium subangular to subrounded gravels; boundary gradual and irregular.
8	Brown (10YR 4/3 dry) silt loam; loose to weak granular; rare to common fine to medium subrounded gravels; rare to common caliche veins, with moderate acid reaction that increases downward to its strongest point at the contact with unit 3; boundary is clear and fairly smooth.

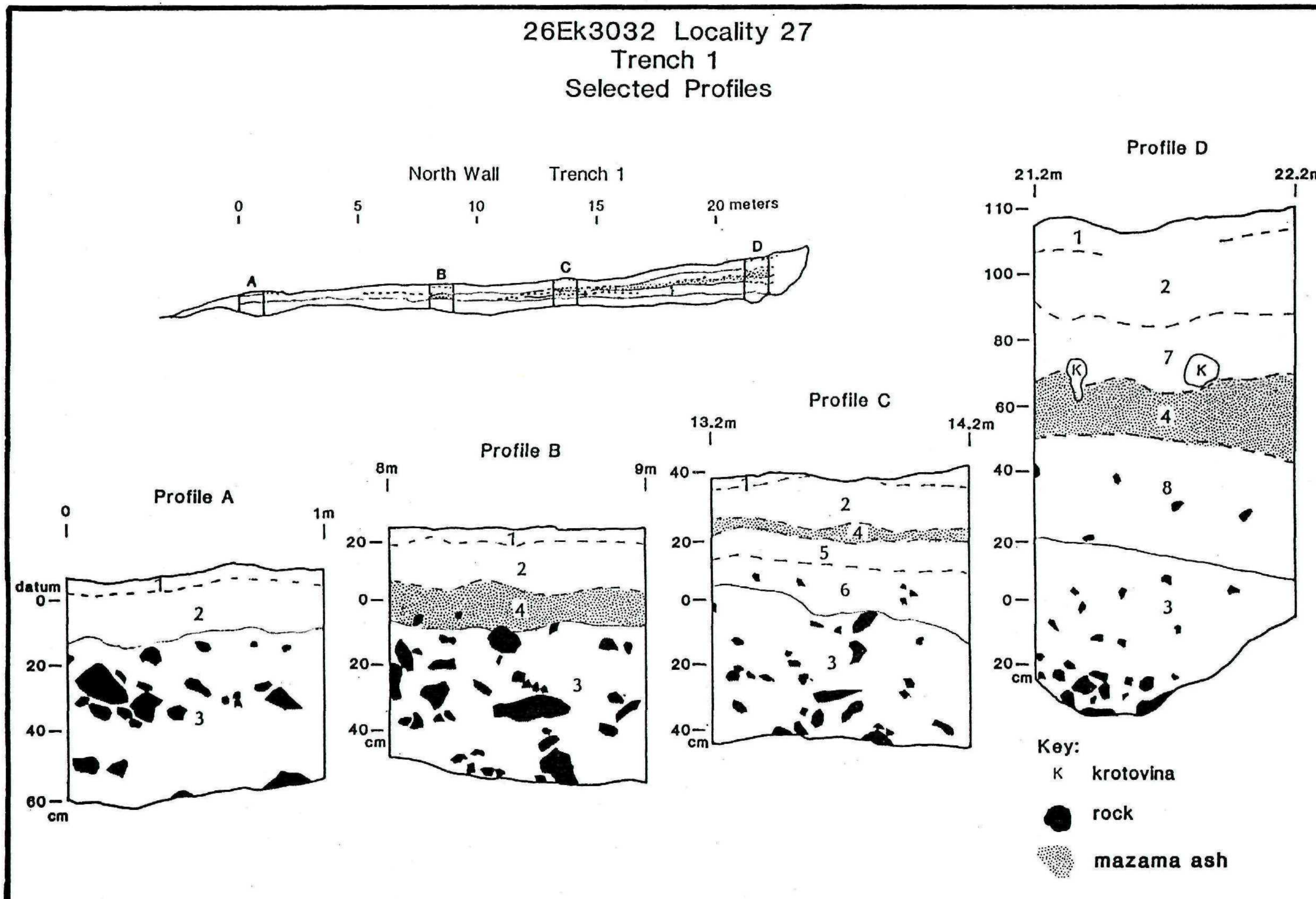

Figure 9. Backhoe Trench 1, selected profiles, 26Ek3032, Locality 27.

Units 7 and 8 are present only at the northeastern end of the trench, while units 5 and 6 disappear. The extent of unit 7, a brown silt loam, might be explained by a past terracing event that stripped it away in the area of the southwestern part of the trench. Alternatively, this unit may be a slopewash deposit that never reached farther down slope. Unit 8, a silt loam with gravels, also may have origins similar to unit 7.

Besides the upper silt loam and ashy units in this area, the deposits in Trench 1 are primarily of alluvial origin, as demonstrated by common subrounded gravels and cobbles. Although no clear evidence of channel cutting or filling could be defined in the subsurface profiles, such alluvial activity is suggested by the upper surface of unit 3, which is irregular and appears to have been eroded. Also, that units 4-8 are not continuous throughout the profile suggests they may have been partially eroded away. Unit 6 may be a sandbar deposit or channel fill.

In summary, Trench 1 contains alluvial depositional units of varying coarseness, overlain by finer silts of eolian and alluvial origin. The most distinct unit in this profile, besides the silty ash, is unit 3. Coarse, somewhat reddish colored sands, clays, gravels and cobbles such as these, appear to underlie most of the site area. Trenches 2 - 4 (see below) and various excavation units show similar deposits. Unit 3 lies below unit 4 (containing Mazama ash) and thus is earlier than 6,800 B.P. This dating accords with the supposition that unit 3 was deposited at some time in the Pleistocene during a period of higher stream discharge than at present. However, there were periods of erosion in this stratigraphic interval lying below the Mazama tephra, especially as indicated by unit 3. This is interesting in light of studies by Haynes (1968) and Madsen (1981) suggesting that in the late Pleistocene and early Holocene, before the Mazama eruption, deposition was predominant in the alluvial systems they studied. Apparently, erosion was also an active, if not predominant, process during this time in the drainage of Undine Creek.

Locality 27: Backhoe Trenches 2 and 3

Trenches 2 and 3 (profiles not shown) are a set of roughly right angle cuts located in the west central area of the meadow (see Figure 7). They were placed here in order to discover any observable interactions between sediments of the two drainages in the area. However, the backhoe was unable to cut through coarse cobbles encountered at shallow depth, and the trenches were only 20 to 80 cm deep. Sediments observed can be summarized as follows. The lowest observed stratum is a coarse layer of subrounded to rounded pebbles and cobbles in a matrix of silty to sandy clays. This coarser unit is generally overlain by clays and silty clays with rarer gravels. Overlying these units are silt loams with pebbles and gravels, some occurring as vague lenses. These units appear to be a combination of sediments of eolian and alluvial origin. Although the deposits in these trenches are clearly the result of sedimentation by the two creeks, segregating them according to which drainage was responsible for a particular deposit was not possible.

Locality 27: Backhoe Trench 4

Trench 4, which runs along a NNW line roughly parallel to Trench 1 at Locality 26, was placed in order to examine an inset alluvial deposit. The deposit was indicated by a vegetation change where the sage brush appeared to be stunted and the grasses were particularly sparse, suggesting some differences in soil or drainage conditions. In addition, there was a break in topography where the steeper relief of the middle and upper hillslope was interrupted by the more gently sloped pocket of materials lying against it.

In Trench 4, evidence for the former position of the hillslope, underneath the inset alluvial deposit, is indicated by the truncation of a carbonate horizon in unit 10 at the southeastern end of the trench (Figure 10; Table 4). Here, the carbonate horizon is part of a reddish clayey paleosol which is commonly found in the subsurface at nearby localities. The truncation of this horizon suggests that former stream activity, at a higher base level, has eroded into the hillside, apparently creating a terrace cut. The clay units, 8 and 9, above this truncated horizon do not appear eroded. Possibly these units were alluvial sediments emplaced after the carbonate truncation episode, and later weathered to clays. There are gravels and cobbles within the clays, suggesting alluvial origins. Another, possibly older, erosional episode is indicated by a break in the relief of the cobbly "bedrock", which itself is probably an older terrace deposit. Clays of unit 6 overlie it. This break occurred about 6.5 meters along the profile from the northwestern end of the trench.

Table 4. Description of Stratigraphic Units, Northeast Wall of Trench 4 at 26EK3032, Locality 27.

Stratum	Description
1	Brown (10YR 5/3 dry) silt loam; weak to moderate, medium subangular blocky; abundant fine roots; rare fine to medium subrounded to subangular gravels; boundary gradual and wavy to irregular.
2	Dark greyish brown (10YR 4/2 dry) silt loam; weak to moderate, medium subangular blocky; common fine roots; rare fine to medium subrounded gravels; boundary clear and smooth.
3	Yellowish brown (10YR 5/4 dry) loam; moderate, medium to coarse subangular blocky; rare to common fine to medium subangular to subrounded gravels; common fine roots; boundary clear and irregular.
4	Light yellowish brown (10YR 6/4 dry) silt loam, with ash; moderate, medium subangular blocky; rare fine roots; rare fine subrounded gravels; boundary clear to abrupt and smooth to irregular.
5	Light yellowish brown (10YR 6/4 dry) silt loam, with some ash; moderate, medium to coarse angular blocky; rare to common fine to medium subangular to subrounded gravels and rare fine subrounded cobbles; boundary clear and irregular.
6	Brownish yellow (10YR 6/6 dry) clay; strong medium to coarse angular blocky; common fine to medium subangular to subrounded gravels and fine subrounded cobbles; boundary clear and slightly wavy.
7	Yellowish brown (10YR 5/8 dry) silty clay; moderate to strong, fine to medium subangular blocky; abundant fine to medium rounded to subrounded gravels and common fine subangular cobbles; boundary unexposed.
8	Yellowish brown (10YR 5/8 dry) clay; strong, medium columnar; rare fine to medium roots; rare to slightly common fine to medium subangular to subrounded gravels and rare fine subrounded cobbles; boundary clear and irregular.
9	Yellowish brown (10YR 6/4 dry) silty clay; moderate, medium subangular blocky; common fine to medium subrounded to subangular gravels, and rare fine subrounded cobbles; boundary clear to abrupt and irregular.
10	Light yellowish brown (10YR 6/4 dry) clay; strong, medium angular blocky; common to abundant (in lower portion of unit) fine subrounded gravels to fine subrounded cobbles; very strong acid reaction on fairly strongly developed carbonate horizon; boundary unexposed.

The clay units mentioned above appear to be part of the inset alluvial deposits detected on the surface. They are not, however, exposed at the surface. Instead, they are covered by silt loams and loams similar to those found elsewhere at this site. In fact, midway along the profile, clays of unit 8 grade into the silty units 2-4, perhaps the result of later alluvial activity that cut into the clays and then incorporated them into the more silty materials. Colluvial processes also may have had a part in this mixing. Unit 9 clays, which seem equivalent to those of unit 6, appear continuous throughout the profile. After examination of the subsurface deposits, it was still unclear as to why the surface vegetation was so sparse; perhaps the clays somehow affected soil drainage.

In summary, the stratigraphy in Trench 4, Locality 27, showed alluvial sediments that had been deposited on an apparent terrace cut into older sediments that had a soil with a calcic horizon partly developed in them. Subsequently, the overlying sediments were weathered to clays, and then eroded and incorporated into adjacent silts. These then were overlain by silts and silt loams.

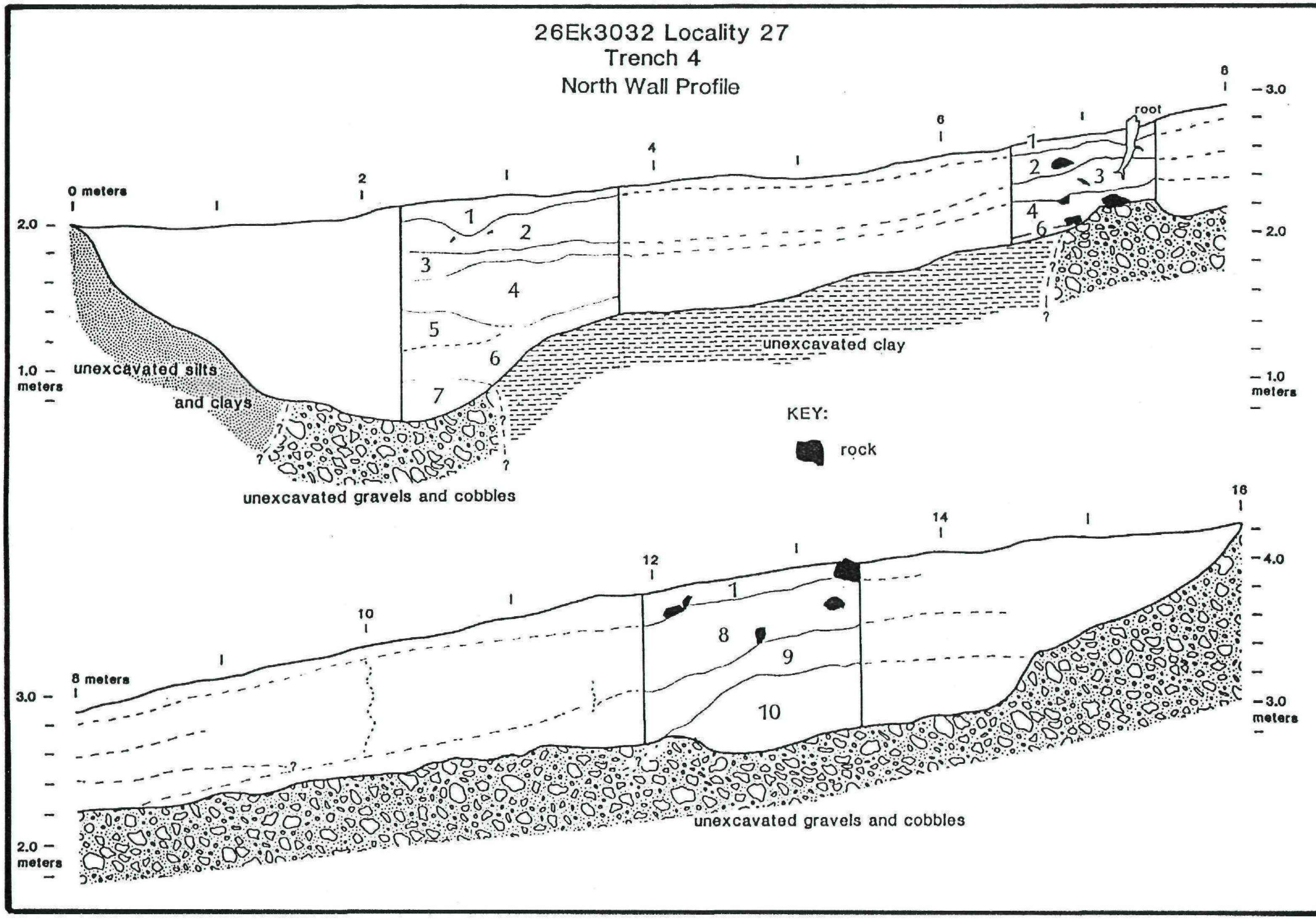

Figure 10. Backhoe Trench 4, north wall profile, 26Ek3032, Locality 27.

Locality 27: Excavation Unit 20

EU 20, a hand dug, 1 m x 1 m excavation unit is approximately 140 cm deep. It is located on a small topographic bench adjacent the west bank of Little Antelope Creek near the southwest corner of the meadow (see Figure 7). The bench is part of a small alluvial terrace related to modern stream activity. Immediately west of EU 20 is a steep, southwest aspect hillslope.

The sediments encountered in this excavation have a simple relationship that is modified by animal burrows (Figure 11, Table 5). Like other profiles examined at this site, the ground surface is covered by a silt loam with common dry organic matter. This surface unit is underlain by two silt loam units distinguished by color. Below these is a transitional unit comprised of silt loam with some ash. This horizon overlies unit 5, a distinctly ashy unit with some silt. Unit 5 contains Mazama tephra and is therefore dated to around 6,800 B.P. (Davis 1978; Appendix A). Below the Mazama tephra are two alluvial units, a gravelly silt loam and an underlying cobbly sandy loam.

Of all the profiles examined at this site, EU 20 contains the cleanest, least silty example of the Mazama tephra. The occurrence of the tephra here and in unit 4 of Trench 1, Locality 27 (see Figure 9), provides a good stratigraphic time marker across the site.

Table 5. Description of Stratigraphic Units, West Wall of Excavation Unit 20, 26EK3032, Locality 27.

Stratum	Description
1	Light Grey (10YR 6/1 dry) silt loam; fine platy to medium subangular blocky; abundant fine roots; abundant fine to medium subangular gravels; boundary clear and smooth.
2	Light brown (10YR 6/2 dry) silt loam; fine subangular blocky; abundant fine roots; common burrows; abundant fine to medium subangular gravels; boundary gradual and irregular.
3	Light yellowish brown (10YR 6/4 dry) silt loam; fine subangular blocky; common fine roots; common burrows; abundant fine to medium subangular gravels; boundary gradual and irregular.
4	Very pale brown (10YR 7/3 dry) silt loam with ash; fine subangular blocky; rare fine roots; common burrows; common fine subangular gravels; boundary gradual and smooth.
5	Light grey (10YR 7/2 dry) ash with silt; fine subangular blocky, forming competent face but powders easily; common burrows; rare fine subangular gravels; boundary clear and smooth.
6	Very pale brown (10YR 7/3 dry) loam; medium angular blocky; common burrows; common rounded to subangular fine to coarse gravels; boundary clear and irregular.
7	Yellowish brown (10YR 5/6) sandy loam; fine angular blocky; common rounded to subangular fine to coarse gravels, abundant rounded to subrounded cobbles, common rounded to subrounded boulders; boundary unexposed.

The profile in EU 20 is the product of both alluvial and eolian input. Units 6 and 7 have conspicuous subrounded to rounded gravels and cobbles, resembling alluvial sediments found below the Mazama tephra elsewhere at the site. Above the tephra are silt loams with subangular to subrounded gravels that are a combination of colluvial slopewash sediments and eolian silts, probably reworked by stream activity. It is interesting to note the similarity of the profile in EU 20 with that of profile "D" of Trench 1, Locality 27. Each profile is situated between a modern stream channel on one side and a steep colluvial hillslope on the other, suggesting that depositional processes across this site are consistent within similar geomorphic settings.

In summary, EU 20 has a profile with seven recognizable stratigraphic units. The upper four are predominately silty units with subangular, colluvially derived, gravels. These are followed by an underlying unit containing Mazama tephra. Below this marker horizon are two alluvial units with common rounded to subrounded gravels and cobbles.

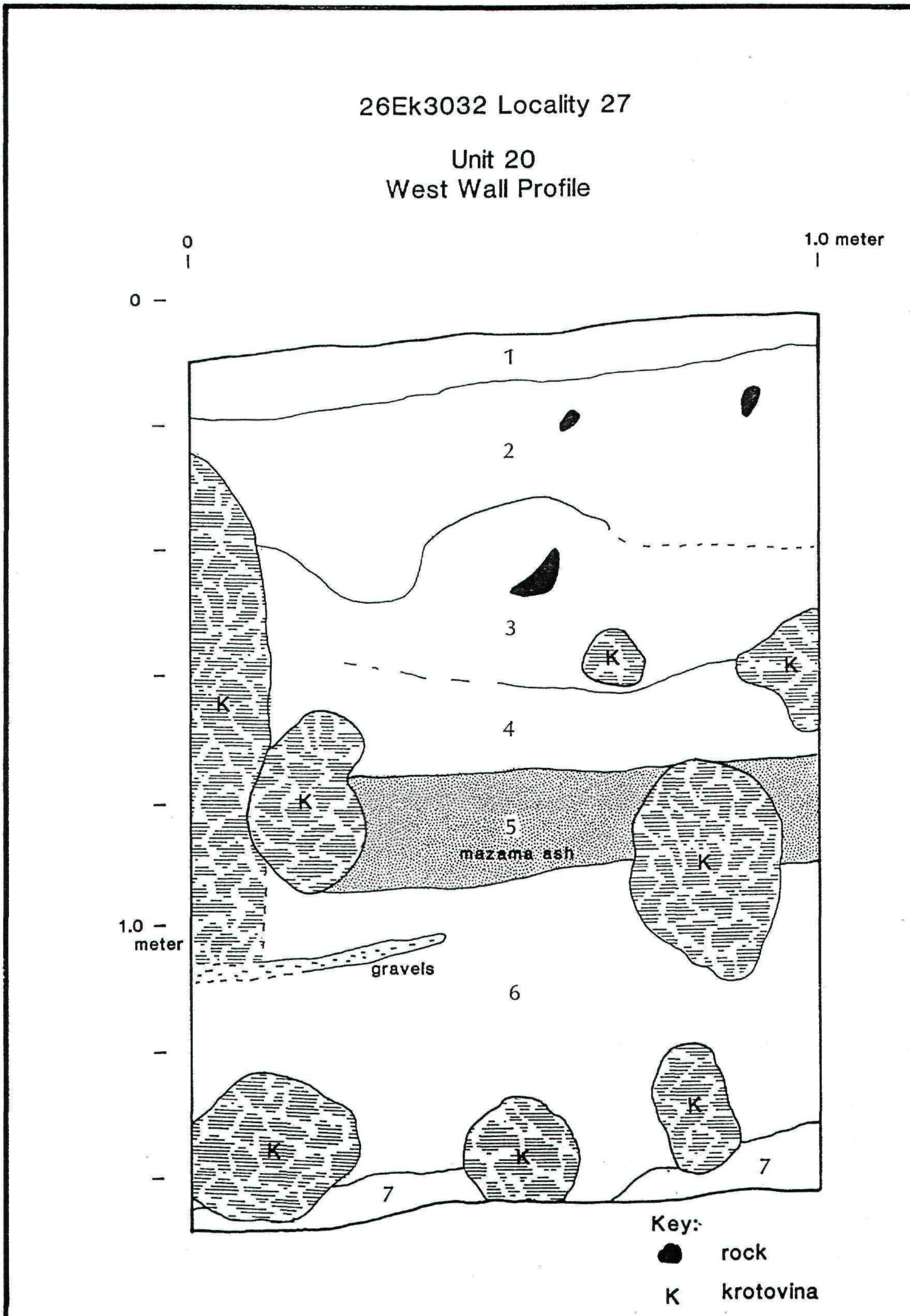

Figure 11. Excavation unit 20, west wall profile, 26Ek3032, Locality 27.

Summary of Backhoe Trench Analyses for Localities 26 and 27

Five backhoe trenches were dug at Localities 26 and 27 in order to study subsurface evidence of past geomorphic activity and cultural quarrying episodes. Three separate quarry pits were revealed in Trench 1 of Locality 26. They contained typical filling cycles of roughly alternating quarrying debris and natural slopewash sediments. Based on the superposition of Mazama tephra, one pit appears to predate 6,800 B.P., but this is contradicted by a ^{14}C date of 510 ± 80 B.P. Stratigraphic units, occurring downslope from these pits, consisted of sandy and silty clays overlain by silt loams. The silty units were a combination of slopewash and alluvial materials. The clays appeared to be strongly weathered alluvial and slopewash materials. These clays and silt loams are roughly correlated to similar sediments seen in Trench 4, Locality 27 (Table 6).

Table 6. Stratigraphic Unit Correlation by Trench, Localities 26 and 27.

Trench 1, Loc. 26	Trench 4, Loc.27	Trench 1, Loc. 27
36, 37 ?	4	4
40	5	-
41	6	-
42	7 ?	-

These sediments, which were interpreted as terrace fill insets overlying an older erosional terrace cut, occur in a blanket-like deposit running along the base of the hillslope. They are likely to be older than the quarrying activity on this hillslope, as quarry debris overlies them, and are probably of Pleistocene age. The terrace cuts in the bedrock and consolidated cobbly material within Trench 1 at Locality 26 and Trench 4 at Locality 27 may be correlated. The cut that is between 15 and 16 meters in Trench 1 is roughly correlated with the break in cobbly "bedrock" that is near 7 meters in the profile of Trench 4. The cut at about 9 meters in Trench 1 may be matched with the truncation of the calcic horizon that is at about 12 meters in Trench 4.

The profile at the northwestern end of Trench 1, Locality 26, is different from those of EU 20 and Locality 27. Here, stratigraphic unit 36 containing Mazama ash grades into unit 37. Unit 37, therefore, can be considered equivalent to unit 36 and thus correlates with unit 5 of EU 20. On the other hand, units above and below the Mazama tephra level in Locality 26, are only roughly equivalent to units in other localities. For instance, below the tephra level in Trench 1, Locality 26, there is another silt loam unit and finally two clayey units that do not match well with units 6 and 7 in the EU 20 profile. This probably is due to differences in geomorphic setting, including the presence of quarry pits upslope in Trench 1, Locality 26, and the relatively smaller scale of the hillslope. Although the quarrying debris from the pits provided abundant clasts to the slopewash sediments, the pits would have inhibited slopewash by acting as sediment traps. This may explain the fewer number of stratigraphic episodes recorded in this section of the profile compared to those seen in EU 20. In addition, there was more alluvial deposition of rounded to subrounded gravels and cobbles in the EU 20 lower elevation profile, compared to the more pedogenically weathered profile at Locality 26 where more clays and relatively fewer coarse alluvial sediments are present below the Mazama tephra level. Thus, the resulting differences between the profiles seen in EU 20 and Trench 1, Locality 26, can be explained by the varied input of alluvial, colluvial, weathering, and cultural processes.

Trench 1, Locality 27, also exhibits alluvial sediments. The most notable unit in this profile is number 3. These brown gravely, clayey sands appear to be part of a fairly consistent and extensive gravel and cobble deposit(s) that underlies much of the meadow area. The reddish color and eroded upper surface suggest this unit is fairly old. It might be correlated roughly with the clayey units that occur in Trench 1, Locality 26; Trench 4, Locality 27, and Trench 2 and 3, Locality 27.

Description and Analyses of Artifact Assemblages, Localities 26 and 27

Projectile Points and Preforms

All the projectile points (n=8) and all the preforms (n=5) in the test sample were recovered from Locality 27. The points were classified with reference to Thomas's (1981) key. Attributes recorded for comparisons are presented in Appendix D. Results reveal that only two of the specimens are attributable to the post-Mazama types considered by Thomas. One other classifiable specimen, a stemmed series point, pre-dates types encompassed by Thomas's scheme (Layton 1979; Clewlow 1968; Frison 1978).

Two points are unclassifiable according to Thomas and three specimens are too fragmentary for classification. Table 7 summarizes classification of the projectile points and photographs of select points and preforms appear in Figure 12.

Table 7. Summary Data for Projectile Points from 26Ek3032, Locality 27.

Specimen No.	Point Type	Material	Fragment Type	Use Data	Loc. of Rework
6062-2	Gatecliff Split Stem	Opalite	Complete	Reworked/Used	
01-130	Large Side-notched	Obsidian	Base Missing	Reworked/Used	Lateral
01-045	Great Basin Stemmed	Opalite	Stem/Base		
6521-1	Out of Key	Obsidian	Complete		
6401-1	Out of Key	Opalite	Stem/Base		
6122-1	Fragment	Opalite	Base Missing	Reworked	
6001-17	Fragment	Obsidian	Mid-Section		
6361-6	Fragment	Opalite	Tip	Reworked/Used	Lateral

Series Classification

Specimen 6062-2 is a Gatecliff Split Stem point (GSS). Its tip is broken and the lateral margins have been reworked. The point was produced on an opalite flake blank, with minimal modification along one margin of its ventral surface. Reworking is absent from its slightly contracting, deeply notched stem. The Gatecliff Series includes a number of stemmed and split-stemmed variants found throughout the Great Basin. The series dates between approximately 3000 and 1300 B.C. (Thomas 1981:36).

A Large Side-notched point (LSN, 01-130) also displays evidence of reworking (Figure 12a). Broken at the tip and neck, it exhibits retouch near the apices of its distal margins that produces a slight shoulder along one edge and a shallow concavity along the other. The point was made on an obsidian flake, with both surfaces reduced to form a lenticular cross-section. Although the base is missing, size and remnant distal shoulder allow classification of the point. Thomas (1981:19) argues that Large Side-notched points are poor time-markers in the Great Basin but suggests they most likely pre-date A.D. 1300.

Specimen 01-45 (Figure 12d), broken below the shoulder, appears to be the basal portion of a Great Basin Stemmed Series (GBSS) point. Basal grinding is present along two-thirds of the artifact margin. Unlike the other projectile points from Locality 27, this specimen appears to have been manufactured from a small biface preform

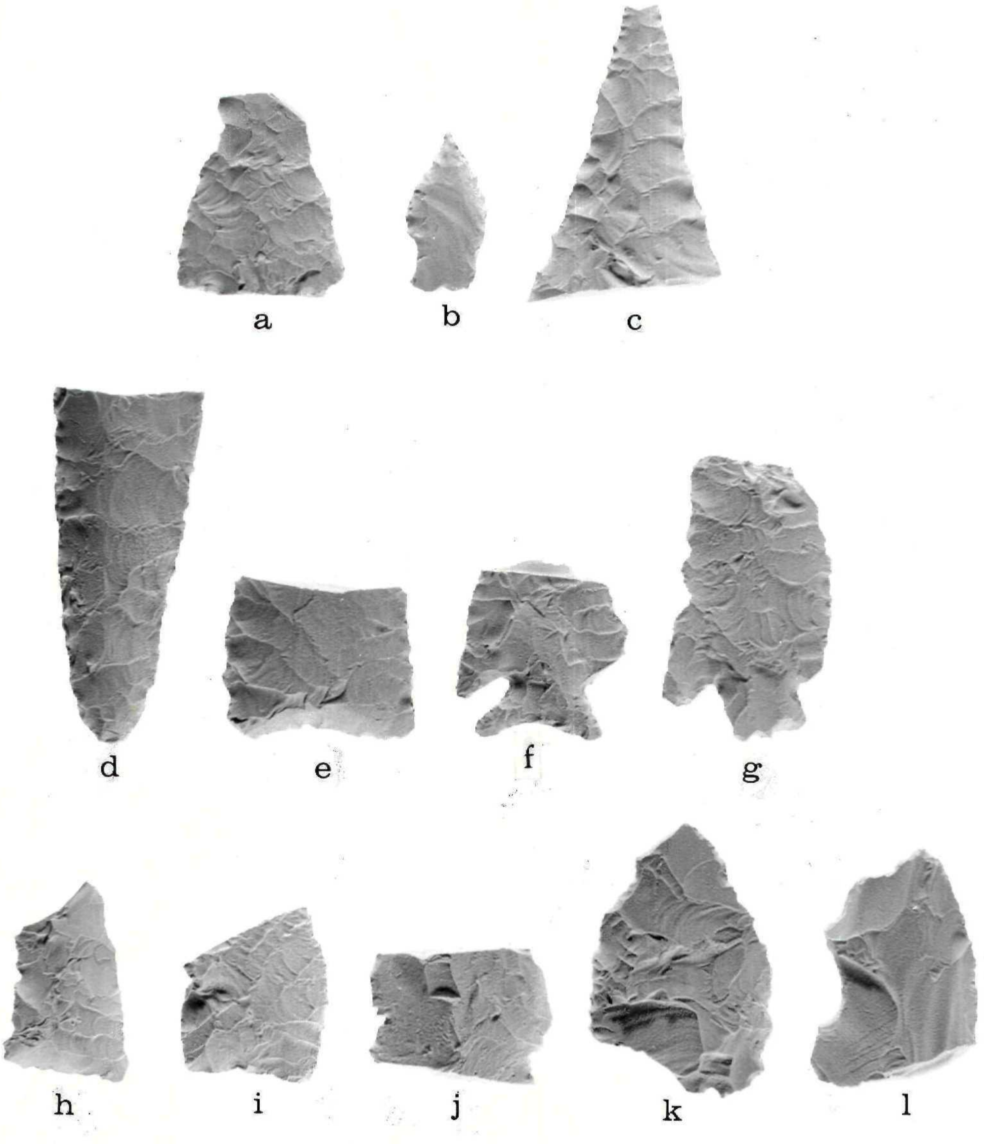

Figure 12. Selected points and preforms from 26Ek3032, Locality 27 and 26Ek3516. Points: a. L27-10-130; b. L27-6521-1; c. L27-6122-1; d. L27-01-45; e. L27-6401-1; f. 26Ek3516-01-15; g. 26Ek3516-01-9. Preforms: h. L27-6380-5; i. L27-6182-2; j. L27-6143-1; k. L27-6143-2; l. L27-6520-1.

preform rather than directly on an unworked flake. Both surfaces are fully reduced, producing a thick lenticular cross-section. The Great Basin Stemmed Series is of considerable antiquity, dating between 8,000 B.C. and 6000 B.C. (Layton 1979; Clewlow 1968; Tuohy 1968, 1974).

Other Points

Two projectile points cannot be classified by Thomas's key. Specimen 6521-1 is small and leaf-shaped in outline, with slight shoulders and a straight base (Figure 12b). Produced on a small obsidian flake, reduction scars on its dorsal surface carry across the artifact midline. Reduction is minimal along the margins of its ventral surface. A broad, shallow notch along one margin precludes its classification as a Cottonwood Triangular type.

Specimen 6401-1 (Figure 12e) is a concave based basal fragment, square in outlined and broken with a snap fracture that could have occurred during manufacture, use, or post-deposition. It is made of white opalite, exhibiting roughly parallel flaking perpendicular to the longitudinal axis of the point.

Of the three pieces too highly fragmented for typological assessment, one (6122-1) may be the tip of a large projectile point or a reworked drill. Both edges are extensively resharpened creating a slightly concave margin (Figure 12c). Specimen 6361-6 is a reworked opalite point tip with an asymmetric outline. The remaining fragment (specimen 6001-17) is an obsidian point midsection. One margin is broken, and no evidence of reworking occurs.

Preforms

Preforms are unifacially or bifacially modified flakes, reduced by pressure flaking to produce a thin cross-section and symmetrical outline. Like biface production, preform manufacture follows a reduction sequence which results in a nearly finished form that may be similar to projectile points in size, shape, and degree of reduction, but lacks final hafting elements. In addition to projectile points, preforms may be made into drills, gravers, knives or other formalized bifacial tools.

The five preforms recovered are pictured in Figure 12 h-l. In outline and cross-section, three of these (6360-5, 6182-2, 01-96) appear to have the general shape of Cottonwood or Desert Side-notched projectile points. Specimen 6360-5 (Figure 12 h) is triangular in outline with a broken tip. Bifacial thinning has resulted in a thin, lenticular cross-section. A grainy inclusion precluded further reduction of one margin. Specimen 6182-2 is also triangular in outline. An attempt to thin a small protuberance along one margin appears to have caused a diagonal fracture near the artifact midline. The entire margin of the dorsal surface and one margin of the ventral surface are reduced. Thinning along the proximal end has produced a slightly concave base. On specimen 01-96, steeply angled flake scars occur along the dorsal margins and all but a small portion along the lateral margin of the ventral surface is reduced. The artifact is roughly triangular in outline, with a rounded tip and straight base. An arris, or dorsal ridge, located near one lateral margin, creates an asymmetrical, triangular cross-section. The maker's inability to thin the arris may have caused the discard of this artifact.

Partial reduction of the remaining two (6143-2, 6520-1) suggests they are early stage preforms; their intended terminal forms are unknown. Specimen 6143-2 (Figure 12k) is broad and somewhat triangular in outline with a sinuous edge. The prehistoric knapper's inability to reduce a bulbar platform on its ventral surface may have resulted in its discard. Specimen 6520-1 (Figure 12l) is fragmentary, with only one lateral margin intact. Flake scars are present only on the ventral surface.

Chronological Implications

Comparison of the projectile point assemblage from Locality 27 with time markers recovered from other sites in the eastern periphery of the Tosawihi Quarries hints at intriguing chronological implications for the use of the locality. Although few in number, the classifiable projectile points from Locality 27 signal comparatively early occupation of the place, from the Pre-Archaic (GBSS) through the Early and Middle Archaic (GSS and LSN). The three small triangular preforms (possibly Late Archaic arrowpoint preforms) offer only equivocal evidence for more recent visitation. By contrast, projectile points (supported by radiocarbon assay and ceramics) from sites in the USX-East relate overwhelmingly to use of the area after A.D. 1300 (Elston and Drews 1991).

This, coupled with the presence of Mazama tephra, suggests that Locality 27 holds data that would allow examination of the earliest periods of use of the Tosawihi vicinity. In particular, it may contain information about the so far only minimally explored interval preceding the intensification of toolstone extraction that typifies land use during Desert times (see Chapter 5, below).

Bifaces

Bifaces are produced through the systematic removal of flakes from a piece of toolstone. Reduction is continuous, but stages can be defined on the basis of points in the reduction sequence where a flintknapper changes reduction goals or techniques (cf. Callahan 1979:33-37). Stage 1 bifaces are unmodified flake blanks, transported from a primary quarry context and intended for bifacial reduction. Stage 2 bifaces have initial margin preparation and removal of irregularities. Stage 3 bifaces have begun to be thinned and have preliminary margin shaping, while Stage 4 bifaces generally are more symmetrical, with straight edges and faces that have been further thinned. Based on the extent and intensity of reduction, these stages are subdivided in order to examine fine-grained distinctions within and between steps in biface manufacture. Stages 2 and 4 are divided into early and late sub-types. Stage 3 bifaces, the predominant forms to be found in the area, have been segregated into early, middle, and late components.

Fifty-nine bifaces were recovered from Locality 26 and 278 from Locality 27. As might be predicted from its function as a toolstone source, specimens recovered from Locality 26 represent somewhat earlier manufacturing stages than do those from Locality 27 (Table 8; cf. Bloomer, Ataman and Ingbar 1991). A large proportion (62.7%) of the biface assemblage from Locality 26 is classified as early Stage 3 and no Stage 4 bifaces are present. At Locality 27 on the other hand, 41.4% are early Stage 3 specimens. These are accompanied by a high incidence of middle and late Stage 3 pieces as well as several early and late Stage 4 bifaces.

Table 8. Biface Production Stages at 26Ek3032, Localities 26 and 27.

					STAGES					
	Stage 1	Early 2	Late 2	Early 3	Mid 3	Late 3	Early 4	Late 4	Indeterminate	Total
Frequencies										
L-26	-	2	8	37	10	2	-	-	-	59
L-27	1	11	23	115	44	21	10	5	48	278
Total	1	13	31	152	54	23	10	5	48	337
Proportions										
L-26	-	3.39	13.56	62.71	16.95	3.39	-	-	-	100.0
L-27	0.36	3.96	8.27	41.37	15.83	7.55	3.60	1.80	17.27	100.0

As noted in Chapter 2, the drainages that cross Locality 27 contain angular and rounded opalite cobbles. These served as an easily accessible toolstone source and were used as blanks for 8.6% of the bifaces produced at Locality 27 (Figure 13); however, none of the bifaces from Locality 26 were made on stream cobbles. Flakes detached directly from outcrops or from extracted blocks, also served as blanks for biface production. The use of flake blanks can be recognized only on early stage bifaces and the proportion of bifaces made on flake blanks is similar in the two assemblages, roughly 12%.

On the basis of the colors and textures of the opalites that comprise them, the assemblages from both localities appear to contain toolstone derived from the pits at Locality 26. The assemblage at Locality 27, however, exhibits an even wider variety of colors than that from Locality 26, suggesting that additional toolstone almost certainly was obtained from other, more distant Tosawihi sources for reduction at Locality 27.

The frequency of heat-treatment (thermal alteration to improve flaking quality) in the two biface assemblages also differs (Table 9). In the Locality 26 biface assemblage, 3.3% of the pieces are heat-treated, while 30.5% of the Locality 27 assemblage was heat-treated. Later stages of bifaces tend to be heat-treated more often than do early stages. In the Locality 27 assemblage, a small number of bifaces were heat-treated as blanks before reduction was initiated, but the vast majority of heat-treated pieces were heat-treated after some reduction had taken place. No bifaces were made on blanks that had been detached from heat-treated cores.

Table 9. Heat-Treatment of Bifaces from 26Ek3032, Localities 26 and 27.

	STAGE									
	Stage 1	Early 2	Late 2	Early 3	Mid 3	Late 3	Early 4	Late 4	Indeterminate	Total
Locality 26										
Heat-Treated	-	-	-	1	1	-	-	-	-	2
Possibly HT	-	1	-	2	3	1	-	-	-	7
Not Heat-Treated	-	1	8	34	6	1	-	-	-	50
Total	0	2	8	37	10	2	-	-	-	59
Locality 27										
Heat-Treated	-	1	1	23	20	14	6	5	15	66
Possibly HT	-	1	1	12	4	4	-	-	12	30
Not Heat-Treated	1	9	21	80	20	3	4	-	21	59
Total	1	11	23	115	44	21	10	5	48	278

The differences between the reduction stages and the incidence and nature of heat-treatment in the Locality 26 and 27 biface assemblages are distinct and correspond to patterns observed in the rest of the Tosawihi vicinity (cf. Bloomer, Ataman and Ingbar 1991). Reduction of bifaces at sites immediately adjacent quarries tends to be early with few pieces heat-treated. At sites more distant from toolstone sources (and especially at places that exhibit residential qualities) biface production tends to be carried further through the reduction sequence and a greater proportion of specimens were subjected to heat-treatment.

Flake Tools

Thirty-eight flake tools (excluding projectile points) were recovered from Locality 27. Of these, 34 are made of opalite and 4 are obsidian (Table 10; Figure 14). Tool types in the collection include scrapers, pointed tools (drills, perforators, or gravers), notched flakes and bifacially-worked pieces (knives, percussion tools, etc.). The most elaborately formed tools, scrapers and pointed tools, make up a considerable portion of the assemblage. None of the pieces is clearly temporally diagnostic, but one, a crescent-shaped scraper (Figure 14j) is similar to specimens attributed to Paleoindian assemblages in the Great Basin (Willig 1988; Hutchinson 1988).

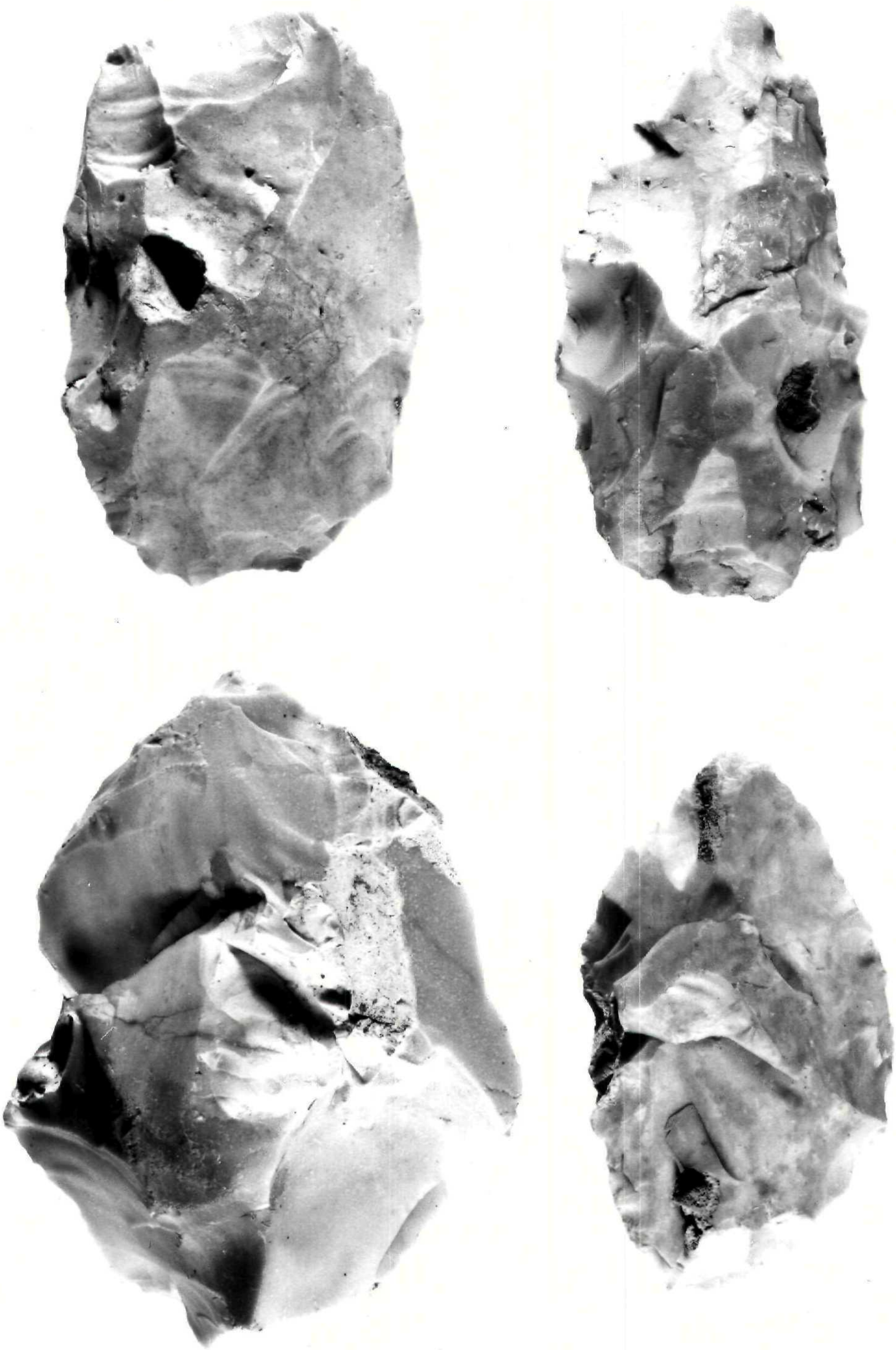

Figure 13. Selected cobble bifaces from 26Ek3032, Locality 27.

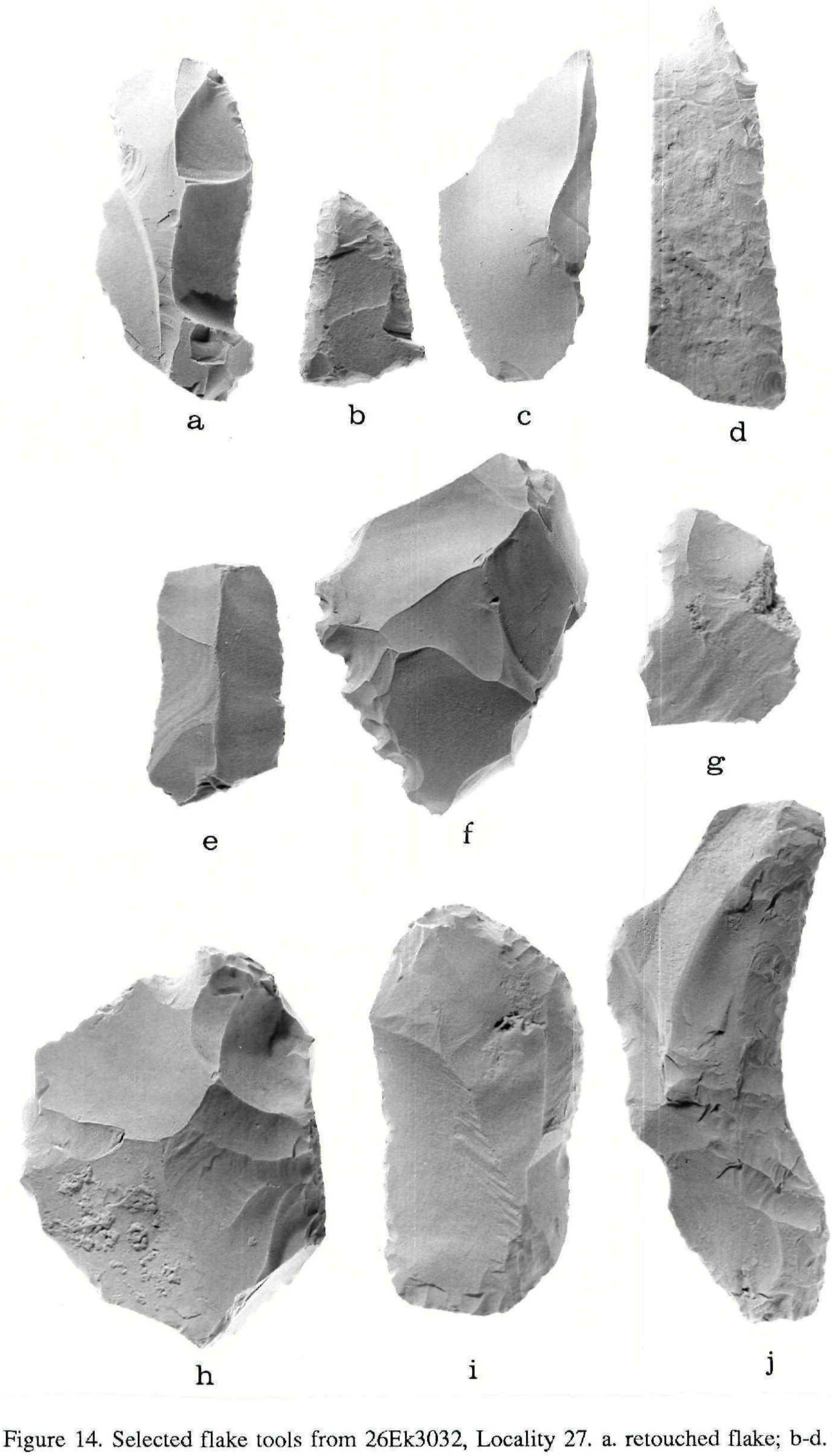

Figure 14. Selected flake tools from 26Ek3032, Locality 27. a. retouched flake; b-d. pointed tools (c. is obsidian); e. obsidian retouched flake; f. denticulate; g. notch; h-j. scrapers.

Table 10. Flake Tools from 26Ek3032, Locality 27.

TOOL TYPE	RAW MATERIAL Opalite	Obsidian	Total n	%
Side Scraper	1	-	1	2.63
End Scraper	4	-	4	10.53
Misc. Scraper or Fragment	5	-	5	13.16
Symmetrically Pointed - Elongate	-	1	1	2.63
Symmetrically Pointed - Short	3	-	3	7.89
Asymmetrically Pointed	1	-	1	2.63
Notch/Denticulate	5	-	5	13.16
Microdenticulate	1	-	1	2.63
Bifacially Retouched Irregular Flake/Chunk	3	-	3	7.89
Pressure-Flaked Tool Fragment	2	1	3	7.89
Flake w/Continuous Unifacial Retouch, 1 Edge & Fragment	5	1	6	15.79
Flake w/Continuous Unifacial Retouch, Multiple Edges	1	1	2	5.26
Flake w/Variable Retouch Pattern, Multiple Edges	2	-	2	5.26
Unifacially Retouched Crude Flake/Chunk	1	-	1	2.63
TOTAL	34	4	38	100.00

Flake tools from Locality 27 are made on several types of blanks, including biface thinning flakes (62.5%), blade-like flakes, simple flakes, and large chunky flakes. Retouch was produced by both percussion and pressure techniques, as well as by use. The variety of colors and textures of opalite from which the flake tools were made exceeds the range of materials observed in both the Locality 26 and 27 biface and debitage assemblages. Thirty-nine percent of the flake tools are of colors other than white, beige or grey.

The functions represented by these flake tools are diverse. Nineteen pieces were examined microscopically for use wear traces using magnifications between 50x and 200x. Details of the methods employed using this technique are described elsewhere (Ataman 1991). Evidence of use is clear on 14 pieces. The range of activities represented by the tools found at Locality 27 includes scraping, cutting, perforating, grooving, chopping and whittling. At Tosawihi, such diversity of flake tool function is common only among sites situated close to water sources and exhibiting other evidence of residential activity, such as pottery and groundstone (Ataman 1991; Leach 1991).

Only one flake tool was recovered from Locality 26. It is a bifacially worked white opalite flake with heavy battering along one edge (Figure 15a). Like similar tools recovered from other quarry pit contexts, it may have served as a quarrying implement (cf. Schmitt 1989).

Cores

Five opalite cores were recovered from Locality 26, while thirteen opalite cores and one obsidian core were recovered from Locality 27. Two of the cores from Locality 27 were made on opalite stream cobbles. All cores appear to have resulted from the production of relatively small flakes. Their shapes vary, but all were classified as blocky, spheroidal, bifacial, conical, or fragmentary. Selected flakes removed from these cores probably were directed toward the production of flake tools rather than bifaces. One core is made on a small obsidian nodule (41.1 mm x 30.8 mm x 21.1 mm) with remnant cortex covering a small portion of its surface.

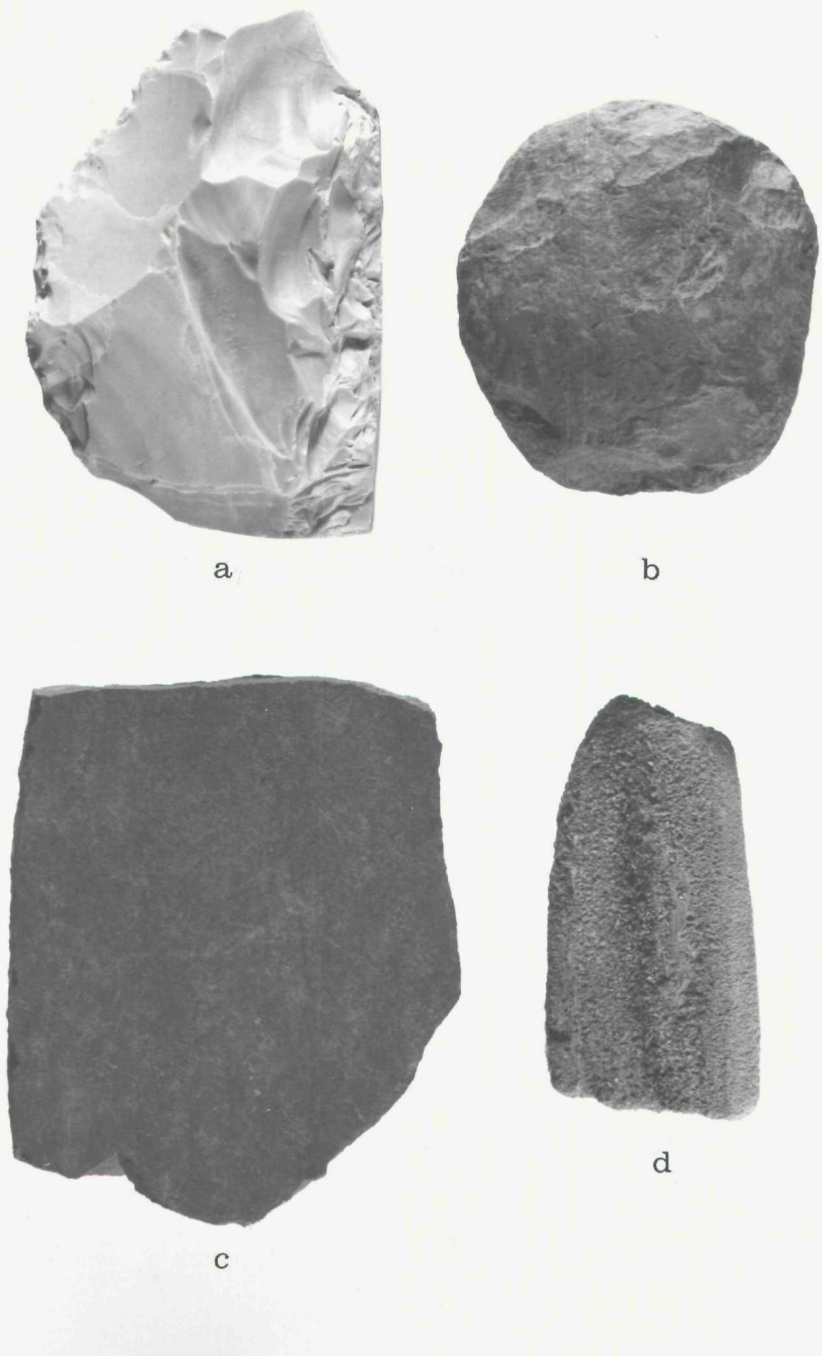

Figure 15. Miscellaneous artifacts from 26Ek3032, Localities 26 and 27. a. flake tool, Locality 26; b. hammerstone, Locality 27; c. metate fragment, Locality 27; d. grooved abrader, Locality 26.

Modified Chunks

Modified chunks are angular fragments with no clear detachment surface and with complete negative flake scars on one or more surfaces. Each of these pieces has undergone reduction, and they probably are by-products of core reduction or very early stage biface production. The end-product of reduction, however, cannot be determined. Nineteen opalite modified chunks were collected from Locality 27 and two from Locality 26. Five Locality 27 specimens exhibit remnants of cobble cortex and may represent assay of easily collected, on-site, raw material.

Percussion Tools

Surface collection and test excavation at Locality 27 returned nine hammerstones. Most (n=6) are small, fist-sized cobbles that can be wielded with one hand (Figures 15b, 16). Although probably employed in the reduction of toolstone (e.g. quarrying or biface manufacturing), specimen 6165-4 displays a relatively large rectangular (4 cm x 3 cm) battered surface, suggesting it may have been used to pulverize foodstuffs (e.g. roots, tubers, rodents).

Surface reconnaissance at Locality 26 recovered ten hammerstones and two choppers (Figure 16, Table 11). The assemblage contains both large hammerstones exhibiting compound spalling and edge-crushing and smaller fist-sized percussion tools. The former probably were used for toolstone extraction while the latter possess often restricted battered margins and probably were used in biface reduction.

Table 11. Attributes of Hammerstones and Choppers from 26Ek3032, Localities 26 and 27.

ALL MEASUREMENTS ARE IN CENTIMETERS

Specimen No.	Material	Length	Width	Thickness	Weight (gms)	Type	Shaped	Complete
Locality 26								
01-11	RH	13.7	9.1	6.1	1173.0	HM	-	-
01-14	QZ	14.7	8.7	6.5	1170.5	HM	-	+
01-21	QZ	10.2	9.1	5.4	518.8	HM	?	+
01-22	QZ	9.6	7.2	5.1	364.2	HM	-	-
01-28	RH	11.2	9.2	4.4	573.9	HM	-	+
01-30	QZ	10.9	9.6	5.3	686.7	HM	-	+
01-35	QZ	11.3	8.8	6.2	704.1	HM	-	+
01-39	QZ	6.8	5.2	3.8	176.4	HM	-	+
01-40	QZ	15.2	10.5	7.1	1303.1	HM	-	+
01-44	OP	10.6	9.1	7.7	848.7	HM	-	-
01-60	RH	11.0	7.4	3.6	336.7	CH	+	+
01-79	OP	9.4	6.3	2.1	155.8	CH	+	+
Locality 27								
01-62	QZ	13.3	11.17	7.7	1434.9	HM	-	+
6167-03	CH	7.5	5.2	4.2	209.2	HM	-	-
01-118	OP	9.6	6.5	4.4	350.9	HM	+	-
01-25	QZ	8.3	6.2	6.9	414.6	HM	-	+
01-150	QZ	5.7	5.8	3.3	172.0	HM	-	+
01-72	OP	7.9	7.0	5.2	352.1	HM	+	+
6061-04	BA	6.7	6.2	4.6	271.1	HM	-	+
6165-04	QZ	7.0	6.1	4.8	393.3	HM	-	+
01-148	RH	13.3	8.7	7.4	1046.3	HM	-	+

Material
RH = Rhyolite; CH = Chert
QZ = Quartzite; BA = Basalt
OP = Opalite

Type
HM = Hammerstone
CH = Chopper

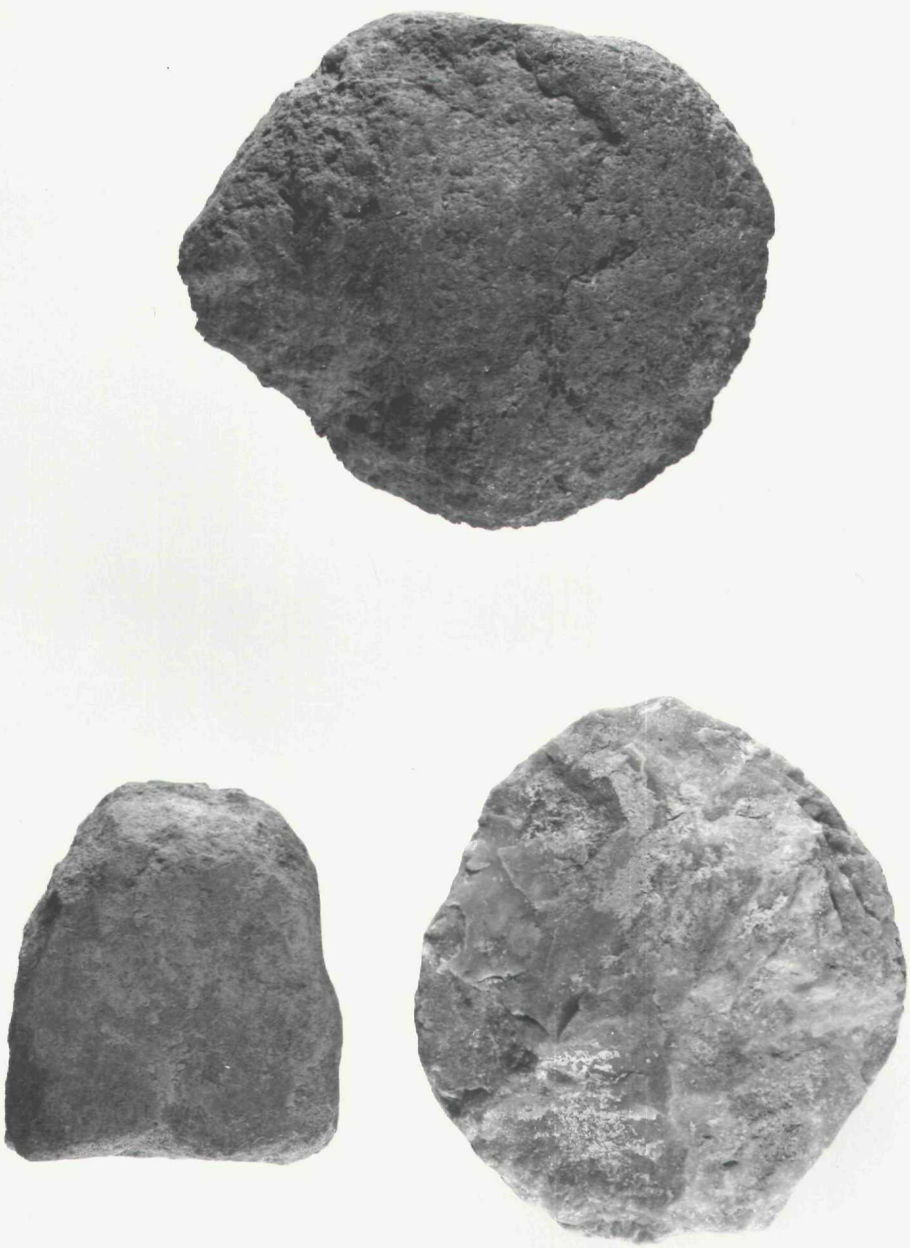

Figure 16. Selected hammerstones from 26Ek3032, Localities 26 and 27.

Like hammerstone assemblages collected elsewhere in the USX-East project area, selection of raw material for hammerstones at Localities 26 and 27 focused on stone obtainable in the immediate vicinity. Most of the hammerstones are made on quartzite stream cobbles; these are available in abundance in the beds of Undine Gorge and Little Antelope Creek (cf. Schmitt 1989).

The margins of the two choppers recovered from Locality 26 are bifacially flaked and battered. Both pieces are complete, specimen 01-60 is of rhyolite and specimen 01-79 is made on a thick opalite flake.

Groundstone

Three manos, four metate fragments, and two abrader/shaft straighteners comprise the ground stone assemblages at Localities 26 and 27. All the millingstones were recovered from Locality 27. Three metate fragments were manufactured on tabular basalt, each displaying superficial use-wear on one surface (Figure 15c), while the other was made on a large piece of abraded tuff. The manos are fist-sized rhyolitic cobbles possessing unifacial use-wear (Figure 17). One of the Locality 26 abrader/shaft straighteners is made on an elongated cube of porous tuff. Grooves have been ground into two of its opposing faces (Figure 15d). One groove is broad and shallow and could have functioned in shaft straightening, but the function of the more narrow groove (width = 3.5 mm) is ambiguous. Its small size suggests that it was employed in the manufacture of bone tools (e.g. needles or awls), or that it was used to prepare the edges of bifaces or points for pressure flaking. A second tuff abrader was also recovered from Locality 26, but it displays only superficial wear and could have been used as a platform abrader in biface production.

Ceramics and Beads

Eleven ceramic sherds were recovered from Locality 27. From differences in wall thickness, temper constituency, and provenience, we infer that they represent at least three different vessels. Excavations in level 1 of EU 4 recovered a single Grayware sherd. In this piece, temper consists largely of angular and subangular quartz grains and possible feldspar. Color, temper qualities, and wall thickness suggest the specimen represents either Promontory or Snake Valley Gray, both dating between ca. A.D. 900 and A.D. 1300 (Madsen 1977). Grayware has been discovered elsewhere in the Tosawihi Quarries vicinity, including nearby sites 26Ek3171 and 26Ek3198 in the USX-East project area (Schmitt and Juell 1989; Schmitt 1991).

Ten Shoshone Brownware sherds were recovered; six were collected in EU 9, and four in EU 19. Shoshone Brownware is poorly dated, but most likely postdates A.D. 1300 in Northern Nevada (Madsen 1986:214). The occurrence of Shoshone Brownware is widespread in the central and eastern Great Basin (cf. Fowler 1968); sherds of this material were recovered from four other sites adjacent the Tosawihi Quarries (Schmitt and Juell 1989).

An elaborately incised stone (tuff?) bead was recovered from the northern portion of Locality 27 in level 3 of EU 2 (Figure 18a). The bead is cylindrical in overall shape, rectangular in cross-section (mean thickness = 13mm), and circular in plan (diameter = 20mm). A biconically-produced hole perforates the center of the piece. A series of decorative striations, parallel to the central perforation, encompass its outer margin, and these are bisected by a single groove around its circumference.

Figure 17. Manos from 26Ek3032, Locality 27 and 26Ek3516.

Figure 18. Beads from 26Ek3032, Locality 27. a. tuff bead; b. bone bead or bead preform.

Excavations in level 2 of EU 5 yielded a rabbit-sized tibia fragment with a scored surface just distal the fibula-tibia junction (Figure 18b). Based on the location of scoring and lack of use-wear (e.g. polish along the cut margin), the artifact represents bone debitage produced during the on-site manufacture of bone beads (see discussions in Schmitt 1990).

Faunal Remains

Seventy bones were recovered from test excavations at Locality 27. Most (n=45) are small mammal remains represented largely by complete, undamaged elements (often clustered in excavation unit/levels) suggesting on-site natural mortality (e.g. burrow deaths). Identified small mammals include ground squirrel (*Spermophilus* sp.) and pocket gopher (*Thomomys* sp.). Additional taxa include the remains of marmot (*Marmota flaviventris*), jackrabbit (*Lepus* sp.), and pronghorn (*Antilocapra americana*). Although much of the taphonomic history of these latter specimens remains ambiguous, a fractured pronghorn distal tibia recovered from level 6 of unit 5 and a charred jackrabbit longbone fragment from unit 9 probably represent human subsistence refuse.

Due to excellent faunal preservation in the meadow, further excavation and detailed analysis of animal bones retrieved from Locality 27 may offer a unique opportunity to explore human subsistence in association with quarrying activities.

Historic Artifacts

Excavators recovered a small assemblage (n=133) of recent era artifacts from the north area of Locality 27. The metal, glass, and plastic fragments represent at least 33 individual objects. Artifacts of a personal nature include a clothing zipper part, an iron hobnail, glass mirror fragments, and aluminum-top beer or soda cans, with ring-type pull tabs. Domestic, architectural, and draft animal activities are reflected by one all-aluminum sardine can, five wire nails of 8d to 20d size, a carriage bolt, and a copper rivet used for leather harnesses. Hunting or plinking is suggested by 14 cartridge parts, 12 of them .22 caliber casings with various headstamps. One specialized tin can, four colorless glass bottles, and a white plastic rod are included, though exact functions are unknown.

All historic artifacts from Locality 27 were recovered from the upper 10 cm of several excavation units. Together, they paint a picture of temporary, probably "day-use only" occupation. Identifiable food and beverage containers held ready-to-consume commodities, such as one might take along for working, hiking, horseback-riding, or practice shooting. No cooking gear is represented. Recovered clothing and shoe parts reflect work/outdoor articles. Day-users may have included cowboys stopping to water their herds, drillers and geologists involved in mineral exploration, hunters, or recreationists.

Appendix C illustrates the known time ranges for artifacts recovered from Locality 27. All but one of the datable artifacts, regardless of their initial years of development, are currently manufactured, suggesting 1) that all the recovered artifacts were deposited after 1970 (the earliest manufacture date of the artifact with the most recent time range), or 2) that several short occupations occurred at the site, reflected by a cluster of initial manufacturing dates occurring every 50 years. Since seasonal water is available here, a rarity for the project area, one would expect it to have attracted people and animals through the years.

Technological Analysis of Lithic Samples: Locality 26

The specific objective in analyzing the 33 lithic samples collected from the Locality 26 quarry pit was identification of reduction debris types associated with each stratigraphic unit, thus allowing inferences as to the locations of different biface reduction stages relative to quarrying. Ethnographic work among Australian Aborigines provides a record of quarrying behavior which we have used to model the expected patterning of archaeological remains resulting from quarrying and toolstone reduction (Binford and O'Connell 1984). When quarrying, the Alyawara reduce large cores to manageable size in the bottom of their quarry pit, then move out of the pit to continue the reduction process. Experimental flint knappers at Tosawihi followed a similar pattern (personal observation by B. Bloomer, 1989). If prehistoric quarriers at Locality 26 engaged in this pattern of moving to another location to accomplish later stage reduction, the behavior might become evident through technological analysis of their reduction debris.

Quarrying and processing toolstone is a continuous process which can be divided into several stages for analytical purposes: quarrying (toolstone extraction), core reduction to produce flake blanks (Stage 1), biface edge preparation (Stage 2), primary biface thinning (Stage 3), and secondary biface thinning (Stage 4). Quarrying often produces fragments of unsilicified tuff, shattered toolstone, and nondiagnostic flake fragments. Stage 1 reduction produces shatter and interior flakes which result from removing surface irregularities in preparation for the removal of a flake blank. Stage 2 reduction is indicated by the presence of edge preparation flakes. Stage 3 and Stage 4 reduction produce early and late stage biface thinning flakes, respectively. The presence, absence, and relative quantity of each flake type was considered in the interpretation of the general reduction activities that produced the sample debitage.

A reduction event includes all the reduction activities occurring in one place at one time, and is marked by the debitage produced and discarded there. If material is processed through more than one reduction stage at a particular location, the debitage will reflect more than one stage. Changing locations at any point along the reduction continuum essentially ends that reduction event and begins another, even if the stage of reduction does not change.

The relationship between the archaeological location of debitage and its place of production is not necessarily direct. Geological processes, as well as human behavior, can affect the archaeological record. Fortunately, stratigraphic analysis allows us to interpret the integrity of the archaeological remains in each stratigraphic sample (see Figure 8 and Table 2).

Technological analysis indicates that the reduction of toolstone ranged from bedrock quarrying through the production of Stage 1 biface blanks and Stage 2 margin preparation to Stage 3 primary biface thinning (Table 12). There was no indication of Stage 4 reduction, an observation compatible with the high frequencies of Stage 2 and 3 bifaces collected from the surface of Locality 26.

All stratigraphic units in the three quarry pits (parts of units 2, 4, 7, and 10; units 6, 9, 12, 14, 25-28, 30, and 32) contain debitage from *only* quarrying, and Stage 1 reduction and/or Stage 2 reduction (see Table 12 and Figure 8). Although most of these units represent primary deposition, unit 6 in pit 2 (see Figure 8) appears to be a secondary deposit of reworked backfill from pit 1, and unit 2 appears to be a combination of slopewash and reworked quarrying and reduction debris.

In contrast, Stage 3 biface reduction debitage occurs primarily in units near the surface, deposited well after the quarry pits had been filled. Debitage from quarrying, Stage 1 reduction, and Stage 2 biface reduction often occur in association with Stage 3 biface reduction debitage in these upper lenses. This indicates that Stage 3 biface reduction usually did not occur within open quarry pits, but was performed on the level surface provided by a filled or partially filled quarry pit. This general use of space conforms to that observed ethnographically among Australian Aborigines working at quarries (Binford and O'Connell 1984).

Table 12. Technological Characterizations of Reduction Present in Backhoe Trench 1, 26Ek3032, Locality 26.

Stratigraphic Unit	Sample No.	Stages Represented
1	2599-600	1,2
1	2599-610	1,2,3
2	2599-603	2,3
2	2599-602	1,2
4	2599-604/5	Q,1
5	2599-606	Q
6	2599-611	1
7	2599-607	1,2
9	2599-608	1
10	2599-609	1
10	2599-612	2,3,1
12	2599-613	1
13	2599-615	1,2
14	2599-614	1,2
16	2599-616	2,1,3
17	2599-617	2,3
21	2599-618	1,2,3
21	2599-631	1,2,3
21	2599-601	1,2,3
23	2599-619	1,2,3
25	2599-625	1
26	2599-620	Q
26	2599-621	Q
26	2599-626	1,Q
26/27	2599-628	1,Q
27	2599-627	Q,1
27	2599-622	Q,1
28	2599-623	1
30	2599-624	Q
30	2599-629	Q
32	2599-630	Q,1
33	2599-632	1,2,3

Q = Quarrying Debris 2 = Edge Preparation
1 = Initial Core Reduction 3 = Primary Thinning

Note: Manufacturing stages are listed in order of greatest frequency in the sample.

Stratigraphic unit 10 (quarry pit 2) explicitly reveals this expected pattern of quarry locality biface reduction. In this unit, early stage biface reduction debitage (for example, sample 2599-609) is found in the bottom of the quarry pit, and Stage 1-3 reduction debris (sample 2599-612) is found on the berm away from quarrying activity. The reduction assemblages in these two samples indicate the reduction of material extracted in a single quarrying episode, segregated into at least two reduction events. These samples each contain debitage produced through the reduction of one or more pink opalite cores and/or flake blanks, probably extracted at the same time. Our model suggests that the Stage 1 debitage in both samples could have resulted from core reduction in the bottom of the pit and the subsequent removal of the same core or a large irregular flake blank to the berm for further reduction.

The stage analysis of the debitage samples, and a consideration of their spatial relationships, indicates that only early stage reduction occurred within quarry pits, while all stages of reduction occurred outside their immediate vicinity. This allowed quarrying activity to continue concurrently with Stage 1, 2, and 3 reduction. Additionally, toolstone probably was quarried a short distance east or west of quarry pits 1-3, some time after the pits were filled. The quarried stone then was moved to the area bisected by the backhoe trench and reduced through the continuum to produce Stage 3 bifaces.

The technological analysis of these backhoe trench samples demonstrates that the samples are technologically distinct from one another and that they can be used to interpret depositional patterns which result from quarrying and reduction activities.

Debitage Analyses: Locality 27

Debitage is by far the dominant artifact class at Locality 27. Testing recovered 26,632 platform-bearing flakes (henceforth abbreviated as PRB flakes) and marginal fragments of flakes without platforms (henceforth called flake fragments). All told, flake fragments and PRB flakes weigh 51.4kg. An additional 19.2kg of angular debris were also collected. In total, the debitage sample consisted of 209 samples from 20 test EUs and 3 surface collections. All samples from the 20 test EUs were screened through 1/4 in. or finer (1/8 in.) mesh. Only samples from the excavation units are discussed here. The few additional flakes collected from non-EU surfaces are not useful analytically since mass analysis requires a consistent size minimum.

The goal of analysis for the Locality 27 debitage sample was a relatively simple one: we wished to assess the potential information present in the debitage sample. Strategies for reaching this goal can be phrased as a series of questions:

(1) Is artifactual material largely confined to the surface, with diminishing densities below surface indicating post-depositional creation of a subsurface record?

(2) Is the debitage assemblage homogeneous across test EUs and levels, and thus uninformative?

(3) If negative answers accrue to the above queries, are debitage studies worth pursuing further at Locality 27?

Laboratory and Interpretive Methods

The primary method of debitage study was mass analysis (see Ahler 1989a, 1989b; Bloomer and Ingbar 1991). After separating opalite from other material types, samples were sorted into three categories: flakes or flake fragments with platforms (PRB flakes), flakes without platforms (flake fragments), and angular debris which shows no orientable scar morphology or platform attributes. Both the PRB and flake fragment portions of all samples were then shaken through a nested sieve set of 2 in., 1 in., 1/2 in., and 1/4 in. square mesh. Samples were poured into the largest size grade sieve, and then shaken for 15-20 seconds using a mechanical agitator. Counts and weights within each size grade then were tabulated.

The resulting frequency and mass data then were summed for all samples of the same material type from the same EU and level. These summed samples were interpreted using statistical mass analysis discriminant models developed by Bloomer and Ingbar (1991) from experimental reduction of Tosawihi opalite and other experiments reported by Ahler (1989a). Samples are classified into one of five categories: core reduction; marginal retouch; early stage biface reduction (Callahan [1979] Stages 1 to middle Stage 3); late stage biface reduction (Callahan [1979] middle Stage 3 and later); and mixed biface reduction (both early and late stage biface reduction, i.e., spanning the mid-Stage 3 period of biface reduction).

An important limitation of the mass analysis discriminant procedure is its dependence upon a sample larger than fifty items that also contains at least one item in the 1/4 in. screen (see Bloomer and Ingbar 1991). Samples smaller than fifty items are not reliably classified under this technique. Although not all the debitage samples could be characterized because of this limitation, ancillary uses for the separation of PRB flakes, flake fragments, and angular debris are illustrated below.

PRB flakes, flake fragments, and angular debris were kept separate during laboratory data collection so that they could be analyzed further. The ratio of PRB flakes to flake fragments provides a measure of flake breakage. Flake breakage models are not well developed in the literature (e.g. Amick and Mauldin 1989; Prentiss and Romanski 1989; Sullivan and Rozen 1985), perhaps because flake breakage can result from numerous factors: trampling and fragility of flake form are the most obvious of these. Trampling of flake assemblages should increase the frequency of flake fragments, resulting in a lower mean flake weight. Different reduction techniques can produce this same signature. If flakes break more frequently when they are thin, as in late bifacial reduction, then mean flake weight will decrease as the number of flake fragments rises. We use flake fragmentation frequencies (comparison of flake fragment to PRB flake frequency) as a rough measure in vertical comparisons between levels within the same EU to assess either possibility. Thus, variation in flake fragmentation proportions are indicative of *some* difference between levels, but its cause is not specified.

Mean flake weights can be useful in assessing different kinds of reduction. Variation in mean flake weights can result from differential fragmentation. Without separate tabulation of complete flakes (with intact margins and platforms), the effects of fragmentation cannot be separated from those of differential reduction technique (or core size). Consequently, we use mean flake weight to assess variation vertically. Again, when variation is found, further examination is indicated to determine whether it reflects differential breakage or reduction technique.

In addition to these measures, a sample of debitage collected from EUs at Locality 27 was scanned for technological attributes indicative of the types and stages of reduction evident in the flake sample (Bloomer and Ingbar 1991). This typological analysis permits comparison of the mass analysis results to educated estimates of the range of reduction activities resulting in debitage.

Mass Analysis Results

Mass analysis results are not highly variable for most of the interpretable samples (Appendix F), which are interpreted as early stage biface reduction. A few levels are interpreted as mixed biface reduction (in EUs 3, 9, 12, 20, 21, 23, 27).

Compared to other settings close to the main Tosawihi toolstone sources (Bloomer and Ingbar 1991), the results are unexpected. A majority of samples from other localities within Ek3032 analyzed using the same techniques were dominated by Core Reduction characterizations. Thus, given the proximity of Locality 27 to the toolstone source at Locality 26, it is surprising that no samples were characterized as Core Reduction. The *relatively* "late" characterization of the Locality 27 samples indicates something quite different at this locality than at Ek3032 localities reported by Bloomer and Ingbar (1991).

Variation in Flake Densities and Fragmentation

Variation in flake densities is marked both across EUs and vertically within units at Locality 27 (Figure 19; Appendix G). There appear to be two patterns in overall flake density: some EUs have the highest densities of items within 2cm of the ground surface, with consistently diminishing densities below the 10cm level (EUs 1, 2, 4, 6, 10, 13, 21; see Appendix F and Appendix G). The consistent decrease in density may be the result of upward transport of flakes from a buried surface, or downward transport from surface. However, it also can result from a steady rate of natural deposition and from an increasing intensity of debitage generation by human actions.

Other EUs have decreasing debitage densities below surface, punctuated by one or more steep increases in flake density (EUs 3, 5, 7, 8, 9, 11, 12, 18, 19, 20, 23, 27; see Appendix G). These are most parsimoniously interpreted as showing episodes of stability-instability in sediment deposition under a constant rate of debitage discard or steady deposition rates punctuated by episodes of higher debitage discard. In any case, they indicate substantial subsurface variation that is relevant to understanding both prehistoric use of the Locality 27 area and local geomorphic environments.

EU 25 differs from both density profile patterns discussed above. Debitage density in EU 25 increases consistently with depth below surface (Appendix G). The test unit may have hit a buried surface or diffuse buried horizon of occupation, while mantled in its upper 10 to 20 cm by redeposited material.

Flake fragmentation can be measured roughly by comparison of frequencies of all flakes to PRB flakes by level for each EU (Appendix G). In general, the number of fragmented flakes is greater than that of PRB flakes, but trends between the two closely parallel each other within any given EU. This result suggests that little trampling has occurred. This should only be considered a suggestion, however, since differential fragmentation may be more subtle than this examination can reveal.

Mean Flake Weights

Mean flake weights can provide some information on the sizes of items reduced and the flaking techniques employed in doing so. As well, the mass of a flake, when considered as a sedimentary particle may affect its potential for subsurface movement through turbation, wet-dry sediment changes, and freeze-thaw cycles. For this examination, the total weight of flakes (PRB and flake fragments) was summed and divided into the total count of flakes. Several general patterns are present. Decrease in flake weight with increasing distance below surface, followed by a sharp increase (usually 40cm or further below surface) in mean flake weight is one general profile. EUs 1, 2, 3, 4, 5, 7, 8, 9, 18, 20, and 23 follow this pattern. General diminution in mean flake weight is present in several other EU profiles: EUs 6, 10, 11, 13, 21, 23, 25, and 27 all share this pattern. The three remaining EUs have various profiles. EU 12 increases greatly in flake weight between 2 and 10cm below

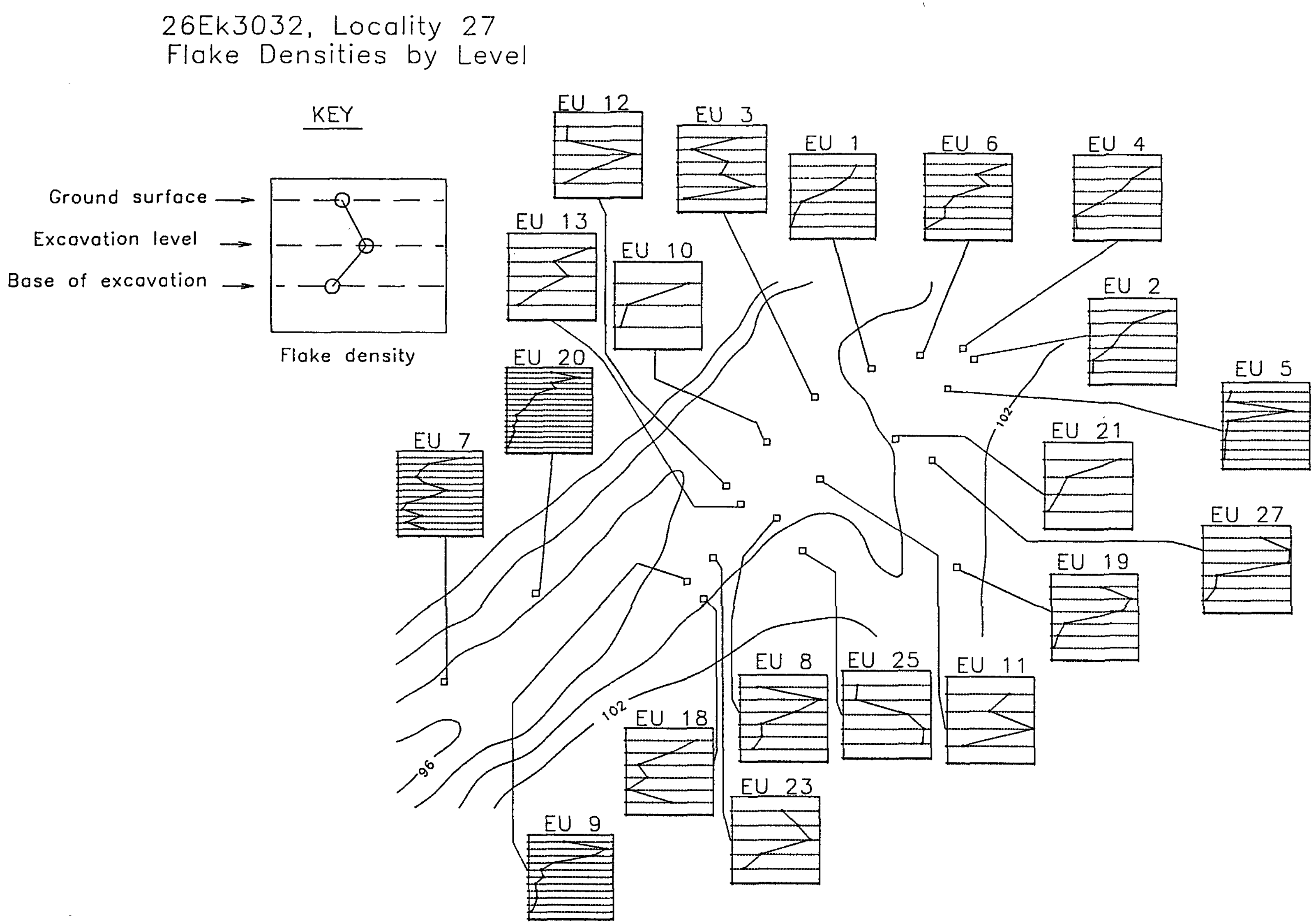

Figure 19. 26Ek3032, Locality 27, flake densities by level.

below surface, and then diminishes again. Interestingly, the greatest frequency of flakes lies just under this increase in mean flake weight—perhaps indicating upward movement of large items by frost heaving from a buried deposit of debitage. EU 19, on the other hand, shows a rough increase in mean flake weight with increasing depth. This trend parallels a decrease in flake frequency: a few large items are present in the lower reaches of EU 19, but not many small ones.

Use of Toolstone Other Than Opalite

Very few flakes of toolstone were recovered that were not opalite (n=153). None of the non-opalite flakes was sufficiently common to effect characterization using mass analysis. Almost all of the non-opalite flakes are jasper (n=103). Obsidian flakes, useful for both dating and sourcing, are infrequent (n=38). The obsidian debitage indicates in-situ production of flakes and early stage bifaces, while the presence of a single pressure flake suggests the possibility of in situ point manufacture. A single basalt flake and two flakes of non-local chert were also present in the debitage.

Typological Debitage Analysis

Thirty debitage samples from individual excavation levels were scanned for indicators of core reduction, biface reduction stage, heat treatment, and other technological variation. Scan analyses were performed on all excavation level debitage from EU 9, and every 10th sample from all remaining EUs. Interpretations of reduction type and stage follow the observations made above concerning analysis of the Locality 26 debitage. Results of the Locality 27 scan analysis are summarized briefly here.

First, it is apparent that the mass analysis characterizations, which are predominantly "early stage biface", mask considerable variation within most of the thirty samples examined. While early stage biface reduction flakes were present in most of the samples, they cooccur with late biface reduction debris and middle (Callahan [1979] Stage 3) biface reduction debris. Thus, the mass analysis characterization is less detailed than the characterization resulting from scan analysis. In general, most samples characterized as early stage biface reduction are more likely Stage 3 biface reduction with some early biface reduction debris intermingled. Moreover, there appears a fairly high frequency of late (late Stage 3, Stage 4) biface reduction within almost every sample. Many of the samples scanned that were classified as mixed stage biface reduction by mass analysis are middle and late stage biface reduction, with virtually no pre-Stage 3 flakes at all.

Second, in half the samples scanned, there were very large relatively late (late Stage 3) biface production flakes. This indicates the production of large bifaces, probably greater than 15cm in length, at Locality 27. These are larger than many of the bifaces known from the Tosawihi Quarries vicinity (Bloomer, Ataman, and Ingbar 1991).

Third, heat treatment is relatively common in the scanned samples. Approximately 10 to 20% of each sample showed obvious evidence of heat alteration. This proportion is high relative to other sites in the vicinity (Bloomer and Ingbar 1991; Bloomer, Ataman, and Ingbar 1991).

Fourth, the debitage samples scanned show considerable variation in opalite material color. This suggests a heterogeneous pool of sources for the opalite, despite the proximity of toolstone at Locality 26. Many of the large *early* biface reduction flakes also showed remnant cortex, indicating use of local opalite stream cobbles for tool manufacture, a finding reinforced by similar findings in the analysis of the bifaces from Locality 27 (see above).

Summary of Debitage Analyses, Localities 26 and 27

Debitage from the quarry pits trenched at Locality 26 clearly is dominated by early stage toolstone reduction; that is, quarried stone processed into forms suitable for further reduction into bifaces. Early stage reduction is the sole lithic production activity within the quarry pits themselves. However, around the quarry pits—on outer berm slopes and even just a few meters from the berms—all stages of reduction were present, including late stage biface reduction.

Within 40m of Locality 26, at Locality 27, there is ample evidence of late stage reduction. It is, in fact, the dominant form of reduction in the locality as a whole. Despite the predominance of early stage biface reduction as the outcome of mass analysis, the scan analysis showed that considerably more late bifacial reduction is present in most of the Locality 27 debitage samples. The disjuncture between these two analytical techniques is not unexpected, and is exacerbated by the very large bifaces that seem to have been produced at Locality 27 (cf. Bloomer and Ingbar 1991).

There appears to be a wider range of toolstone sources represented in the Locality 27 debitage than in the Locality 26 debitage. Our scan analyses suggest that this is the case, since range of flake color and texture exceeds those of the bedrock at Locality 26. The scan analysis also revealed a wide range of material sources and reduction of local cobbles. Heat treatment is relatively high in the Locality 27 sample and low in the Locality 26 sample. The differences in raw material source utilization is especially interesting, for under any cost-minimizing model of prehistoric behavior, we would predict that Locality 26 should have been most heavily used by occupants of Locality 27. That this is not the case suggests these are distinctly different economic settings. They may nonetheless be linked to each other in some fashion or during some intervals of time. If they are, then the movement of quarried products from their place of procurement (a context of production) to their place of reduction into transport forms (a context of use) occurs over a very short distance at these two localities.

Debitage from Locality 27 is differentially distributed both horizontally on the surface, and in terms of subsurface frequencies within any given EU (see Figure 19). Artifactual material is not confined to the surface of this locality, nor does it necessarily diminish in frequency vertically.

Technological differences among samples are suggested by several of the results above: the debitage samples are far from homogeneous in composition. Nor are the debitage assemblages easily understood in terms of prehistoric toolstone exploitation strategies, as the contrast with other analyses of the Tosawihi vicinity shows. Rather, it is apparent that debitage variation at Locality 27 may have two causes, which are not mutually exclusive: (1) variation in the rate of deposition and subsurface processes that may have created peaks and valleys in debitage density and also winnowed the assemblage through movement; (2) variation in prehistoric flintknapping strategies in any given location.

The latter topic speaks to the heart of an important research question concerning the Tosawihi quarries (cf. Elston et al. 1991)—whether prehistoric use of the quarries was consistent or changeable through time. For example, variation within an EU by level could be due simply to minor shifts in where reduction occurred. So, at Time A, EU X was the center of a reduction action, but at Time B (10cm of deposition later), a prehistoric flintknapper left large debris 2m away, and only small-sized pieces of debitage were deposited on the (Time B) surface of EU X. Alternatively, flintknapping strategies may have changed through time, as prehistoric knappers sought and used toolstone in different ways. Obviously, neither of these scenarios can be evaluated on the basis of our present knowledge of Locality 27. Nonetheless, Locality 27 has important information in its debitage assemblage of relevance to both formation processes (with concomitant paleoenvironmental parameters) and prehistoric human behavior.

Chapter 5

RESEARCH POTENTIAL AT 26Ek3032, LOCALITIES 26 AND 27

Localities 26 and 27 of site 26Ek3032 offer avenues for future research as outlined in this chapter. Our discussion of research opportunities springs from the test excavations at these localities, but draws upon prior work at the Tosawihi Quarries (Elston 1989, Elston and Raven 1991). What follows is not a data recovery plan for Localities 26 and 27 (cf. IMR 1988e); rather, it is a general discussion of their research *value* given present knowledge of the Tosawihi archaeological record. Suggestions made concerning procedures to implement a particular line of inquiry are intended as ideas, not prescriptions.

The research potential of Localities 26 and 27 can be divided arbitrarily into two domains of inquiry. The first of these is the natural setting of the localities and its change through time. Paleoenvironmental studies are possible at both locations, and undoubtedly would be fruitful. Integrated paleoenvironmental studies are wholly lacking for the Tosawihi area; our knowledge of past climatic, vegetative, and faunal change comes solely from archaeological inquiry and some geomorphological research (Elston and Raven 1991; Dugas 1991). A second research domain is the understanding of prehistoric activity on and around the two localities, and their relationship to the cultural processes of which they were a part. We discuss each domain separately, merely for ease of presentation since we see no clear boundary between them.

Paleoenvironmental Research

Locality 27 occupies a rare depositional setting in the Tosawihi vicinity. Few other places there contain a combination of deep sediments and essentially depositional environments (Dugas 1991). It is far more common to find a shallow archaeological record at Tosawihi, in which little deposition or erosion occurred. Locality 27 also contains a sedimentary record with a long time span. The presence of Mazama tephra in primary fluvial sediments, in stratigraphic context (although not the primary eolian depositional context of the tephra), clearly indicates a lengthy span of deposition. Thus, unlike most places on the Tosawihi landscape, Locality 27 contains an extensive Holocene sediment pile that well may contain important paleoenvironmental information along with stratigraphically separable archaeological horizons. The terrace sequence itself, described in Chapter 4, is a record of environmental change. For example, the large basal gravels and the erosional terrace surface found in Trench 4 at Locality 27 may be indicators of a generally wetter or more seasonally intense precipitation pattern. Detailed geomorphological study could increase present knowledge of paleoclimates in the Tosawihi uplands by an order of magnitude.

More direct indicators of paleoenvironments may also be present in the sediments of Locality 27. Pollen and opal phytoliths provide primary data on local and extralocal vegetation. If present, these should be sampled intensively and scrutinized, for few other locations in the area offer any hope of stratigraphic separation of these materials.

As noted in Chapter 4, the preservation of bone is relatively good in Locality 27 deposits. Many of the bones recovered in testing may be the waste of human meals: but this too provides information on paleoenvironments. Local and extralocal faunal remains provide a sort of "human's-eye" view of the landscape. Natural death faunas (burrow deaths, natural mortality carcasses) augment this record at the local level. Good bone preservation at Locality 27 suggests the probability of preservation of other organic materials. Charred seeds and partly burned or carbonized wood fragments often can be identified to the species level and yield evidence of prehistoric diet as well as provide chronological controls on stratigraphy through radiocarbon dating. As well, organic artifacts can testify to resources now vanished from the local landscape.

Locality 26 also provides a deep stratigraphic record, although we do not know the range of time represented in it. Most of the stratigraphy is anthropic, created by quarry pit excavation and opalite processing, thus the likelihood that it contains a significant paleoenvironmental record may be less than at Locality 27. Nevertheless the rarity of deep stratification at Tosawihi renders it a potentially important research opportunity. As at Locality 27, pollen and phytolith sampling can be undertaken here.

Intriguing at Locality 26 is the presence of Mazama tephra in a discrete stratum. The single ^{14}C date from this stratum (510±80 years B.P.; Beta-35573) does not match the age of the Mazama tephra (6800 years B.P., see Appendix A), yet this does not necessarily place the Mazama tephra in secondary depositional context. Radiocarbon dates can be wrong, and further dating would easily assess this. Even if the Mazama tephra is in a secondary depositional context, one must still account for its redeposition. From where did it erode? Is it an eolian deposit, perhaps trapped in the pit matrix during a drier interval in the past? Is it a slopewash or colluvial deposit? If so, there must have been soft sediment above the Locality 26 quarry pits which later eroded. Answers to these questions are not obvious, but clearly they have implications for the reconstruction of general climatic events in the past.

In sum, paleoenvironmental inquiry can be undertaken effectively at Localities 26 and 27. Through geomorphological studies of sediment erosion and deposition, pedological studies of stability and surficial sediment weathering regimes, and studies of plant macrofossils with palynological and phytological investigations, a picture of local and regional paleoenvironmental change can be built.

Archaeological Research

A second research domain at Localities 26 and 27 is the study of past human actions. A series of hierarchical topics are envisioned for this investigation. We wish first to know what actions took place at each locality and at what time(s) in the past. Are the two localities contemporaneous? Were products quarried from Locality 26 reduced at Locality 27? What additional functions can be ascribed to Locality 27? Was it used for the same purpose throughout prehistory? The answers to these questions are not obvious at present, though the results of testing indicate that the two localities contain important information with which to address them.

A basic investigative strategy is to seek chronological control. Temporal controls can be built through stratigraphy, radiocarbon dating, and obsidian hydration studies. While several important temporal patterns already have emerged (see Chapter 4), the Mazama tephra uncertainty discussed above shows chronology building cannot be done without concomitant geological investigation. In any case, the presence of Mazama tephra in both localities makes these potentially the oldest subsurface deposits at Tosawihi.

Human use of the confluence of Undine Creek and Little Antelope Creek predates 6800 years B.P. in at least part of Locality 27, and possibly in the oldest pit at Locality 26. The ages of projectile points recovered at Locality 27 do not include Late Archaic forms younger than 1000 years old (although some of the preforms *could* have been used to produce these more recent projectile point types). In contrast, the available dates and time-sensitive artifacts from other parts of the Tosawihi vicinity suggest late use of the area east of the main quarries (Elston and Drews 1991).

Better definition of the ages of materials buried in Localities 26 and 27 would have two great benefits. First, if the Locality 26 quarry pits are contemporary with much of the Locality 27 subsurface materials, then they constitute some of the oldest quarry features yet known at Tosawihi and, as such, will provide an opportunity to contrast quarrying techniques and products of toolstone procurement with the more common, younger quarry pits at Tosawihi. Second, if the Locality 26 quarry pits are younger than much of the Locality

27 archaeological record, then they constitute further evidence of late intensification in quarry use (cf. Elston and Drews 1991). This possibility raises a question about activities undertaken by prehistoric people at Tosawihi prior to the late intensification: what did the pre-quarry pit groups do at Tosawihi? In either case, the importance of the lower, older, archaeological materials at Locality 27 cannot be overstressed, since they can provide important information on change through time in the prehistoric use of the Tosawihi landscape.

Locality 27 contains abundant archaeological data in geological context sufficient to address these questions. The preservation of organic materials, the long stratigraphic record, and the differential vertical and horizontal distribution of debitage and stone tools indicate the potential of this locality to provide data about site function changes through time. Excavations could reveal sequential uses of the locality, revealing many occupations and their associated activities (sorted through time) in a single place.

Beyond addressing "what" and "when" queries, we need to link the actions performed prehistorically at these localities to more general prehistoric use of the Tosawihi uplands (Raven 1991; Elston et al. 1991). Prehistoric use of Tosawihi appears to have been most intense during the past 1000 years. Most of the larger sites studied so far contain abundant evidence of this late use (Elston and Drews 1991). In this regard, it is interesting that no time diagnostic artifacts from Locality 27 unequivocally date to the past 1000 years suggesting that Locality 27 could be more restricted temporally than most other places in the Tosawihi vicinity.

Additionally, previous research in the Tosawihi vicinity indicates that sites close to water or toolstone sources are fundamentally different from sites away from these resources (Elston and Raven 1991). Sites within 250m of water tend to have a full range of tools on them; sites close to toolstone may have a full range of tools as well, but are dominated by the tools and byproducts of opalite extraction and processing. Since Locality 27 is close to both water and toolstone, we then expect the full suite of prehistoric activities to have occurred at this location. However, if the use of the Tosawihi uplands changed through time, then activities at Locality 27 also may have changed. Because of the long stratigraphic record, Locality 27 presents an ideal location to evaluate these propositions.

Chapter 6

TEST RESULTS, SITE 26EK3516

Site 26Ek3516 lies immediately adjacent the northwestern boundary of the Tosawihi Quarries site 26Ek3032, where it is defined by a light density lithic scatter punctuated by two reduction features (Figure 20; see Figure 2). It was discovered during reconnaissance of a proposed realignment of the Main Access Road to the Ivanhoe Gold Company's Hollister Mine (cf. Drews 1988; IMR 1988c, 1988d).

Cursory perusal of the site surface during survey revealed the bulk of its cultural content to be derived from opalite toolstone processing and thereby implied origins for 26Ek3516 comparable to those responsible for the creation of many other sites recorded in the vicinity (cf. Budy 1988). The additional discovery of projectile points and groundstone at this time, however, suggested that the site had witnessed a broader range of behaviors than those of lithic production alone. Coupled with the potential for buried remains offered by depositional contexts, these observations hinted that the place might contain information pertinent to several research issues developed for the Tosawihi Quarries vicinity by Elston (1988). This potential rendered assessment of the National Register eligibility status of the site unclear on the basis of survey level data alone (IMR/BLM correspondence 11/11/88). As a result, the site was tested in order to evaluate its significance vis-à-vis the National Register of Historic Places and to arrive at a determination of the effect road construction would have upon it.

The present evaluation concludes that 26Ek3516 is ineligible for nomination to the National Register.

Site Description

Spanning elevations between 6100 feet (1859 m) and 6050 feet (1844 m) amsl, 26Ek3516 occupies some 8800 m^2 of the flat crest and gentle southern slopes of Mary's Ridge immediately north of Deer Pass, a low saddle that links the central portion of Mary's Ridge with the western end of Twin Butte and serves as the divide between the watershed of Spring Canyon on the east and that of Basalt Canyon on the west (Figure 20).

General site contexts are characterized by a light to moderate density scatter of opalite debitage. Within this occur two cultural features, both of them defined by more dense accumulations of reduction debris (Figure 21). The formed artifact assemblage is small but varied. In addition to the opalite bifaces and other items directly referable to toolstone processing that dominates the collection, implements indicative of maintenance/subsistence tasks are present as well. These include several flake tools, a pair of projectile points, and a mano (Table 13).

Table 13. Artifacts Recovered from Feature and Nonfeature Contexts, Site 26Ek3516.

		DEBITAGE		FORMED ARTIFACTS					
Feature	Area (m^2)	n	wt. (gm)	Proj. Points	Bifaces	Flake Tools	Hammer-Stones	Ground Stone	Total
1	9	-	-	-	-	1	-	-	1
*	2	5	879	2967.7	-	5	2	-	7
Surface Isolates	N/A	-	-	2	11	-	1	1	15
Other Nonfeature	N/A	92	97.2	-	1	1	-	-	2

*Sample Feature

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Note:

One or more pages have been removed from this part of the report due to sensitivity of specific archaeological site location information. Qualified persons may contact the Nevada Bureau of Land Management, Elko Field Office, to inquire about obtaining additional information.

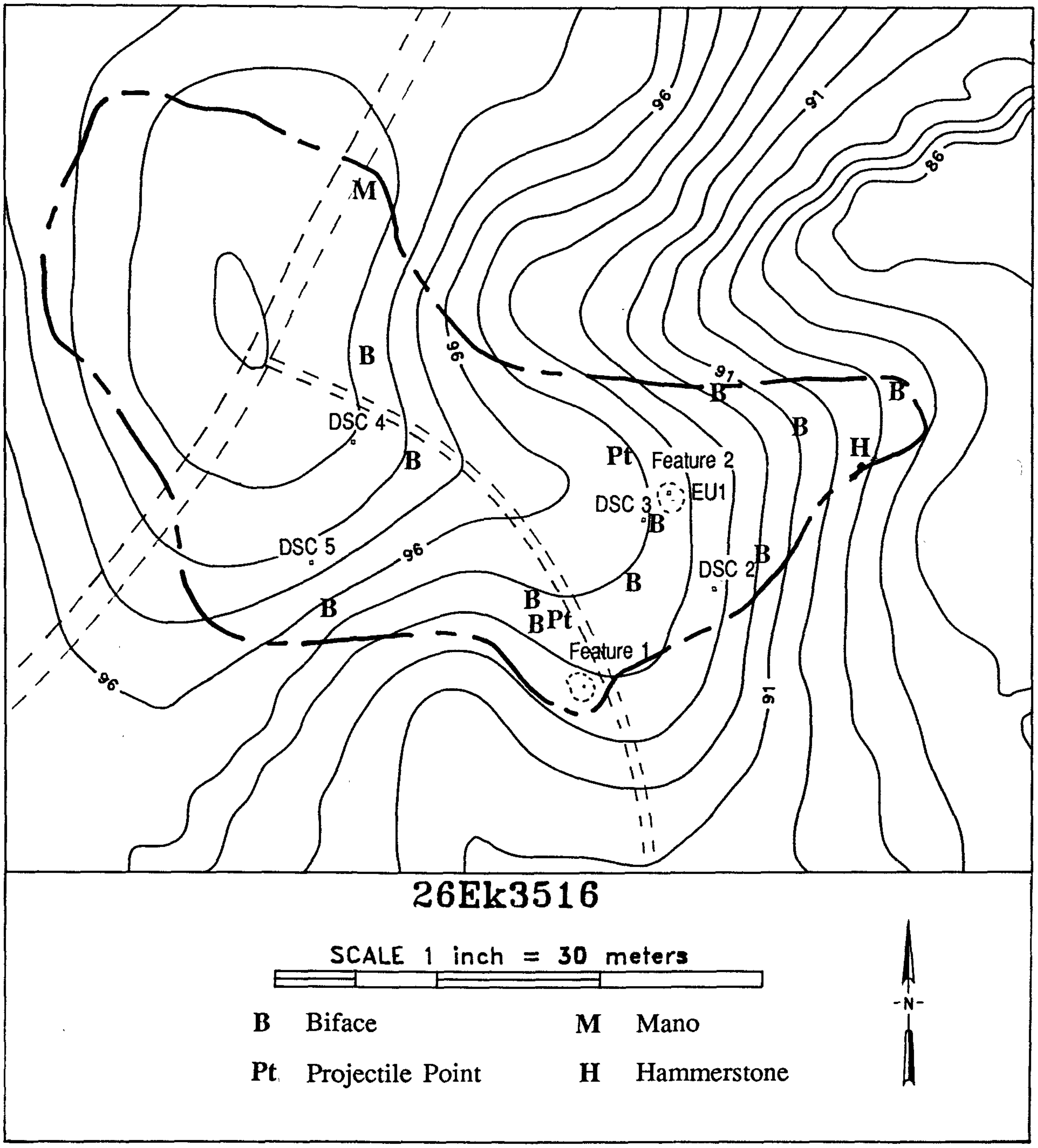

Figure 21. 26Ek3516, site map.

No primary opalite toolstone sources occur within site precincts. Instead, local geology is mapped as platy basaltic andesite (Cornucopia 1987). Site soils are shallow sandy gravelly silts, the product of inplace weathering of the bedrock and contributions of eolian silts. Over most of the site these soils support an open growth of tall sagebrush, low sagebrush, and phlox. Where recent brush fires swept the ridgecrest, nearly half of the site now supports a sparse cover of cheat grass, rabbitbrush, and lupine. Under current conditions, the site lies far from persistent water sources. The nearest perennial supply occurs at Tosawihi Spring, located some 1.5 km to the east and, although water is available seasonally from seeps within upper Basalt Canyon, they are attainable only by means of negotiating several hundred meters of relatively steep slopes.

At the time of fieldwork, the site remained relatively well preserved. The main dirt road linking the Butte, Silver Cloud, and Governor Mines crosses the site from east to west along the ridgecrest and has obliterated a 5 m wide swath through the upper portion of the site. A faint two-track jeep road has inflicted superficial damage where it transits the southern half of the site. Beyond this, the site has been subjected to post-depositional disturbances comparable to those encountered throughout the Tosawihi vicinity (cf. Elston and Dugas 1991). Rodent burrowing is common and has churned deposits extensively while solifluction and colluvial actions, particularly on the steepest site slopes, undoubtedly have translocated artifacts and altered original depositional contexts.

Research Methods

The theoretical approach developed for Tosawihi research by Elston (1988) guided all aspects of the investigation. Field and laboratory methods employed for the collection and analysis of cultural remains were comparable to those applied during the USX testing program in 1988 (Elston 1989:37-46) and were designed to recover data appropriate to the address of specific Tosawihi research questions (Intermountain Research 1988a). Undertaken between April 10 and April 12, 1990, fieldwork at 26Ek3516 included intensive surface reconnaissance, boundary determination, and controlled surface collection and mapping. Minimal controlled subsurface probing was conducted in order to assess the potential for buried remains. Table 14 summarizes collection procedures.

Table 14. Summary of Collection Procedures, Site 26Ek3516.

FEATURES RECORDED		FEATURE CONTEXT		NONFEATURE CONTEXT	
Total (n)	Sampled (n)	Surface Scrape (m^2)	Subsurface Excavation (m^2)	Surface Scrape (m^2)	Subsurface Excavation (m^2)
2	1	1	0.25	4	-

Fieldwork commenced with a close interval (two meter) transect survey of the site surface. By this means formed artifacts and cultural features were isolated and site boundaries were established and mapped. Formed artifacts found in nonfeature contexts were point plotted and collected.

Five discretionary surface collection (DSC) units were employed for the purpose of obtaining a volumetrically controlled sample of the cultural content of the lithic scatter visible on the ground surface and deposits lying immediately out of view just below it. This was accomplished by shovel skimming the upper 2 cm of soil in each unit and passing them through 1/4 inch mesh screen. All cultural material retained by the sieves was collected. Four of the DSC units (Units 2-5) were placed judgmentally throughout non-feature contexts in order to sample the full range of topographic settings offered by the site. The fifth unit (Unit 1) was centered on the densest portion of the surface of Feature 2.

The contents of both cultural features were inventoried, described, drawn in plan, and the formed artifacts on their surfaces were collected. Additional, more invasive sampling focused on Feature 2. The surface scrape unit within it was continued as an excavation unit (EU) in order to assess the vertical dimension of the site. Material was segregated by 10 cm arbitrary stratigraphic levels. A 50 cm x 50 cm quarter of the unit served as a 1/8 inch mesh control quadrant and the remainder of the unit contents were passed through 1/4 inch mesh.

In the laboratory, the recovered artifact assemblage was subjected to data collection and analyses comparable to those undertaken for sites in the USX project areas (Elston 1989:41-45). Standard analytical procedures consistently applied throughout the Great Basin were followed for projectile points (Thomas 1981) and for groundstone (Juell 1990). For bifaces, flake tools, percussion tools, and debitage, procedures modified for specific application to Tosawihi research were employed (Elston and Raven 1991).

Analytical results were incorporated into the Tosawihi Project electronic data bases. Permanent curation of the artifact collection and field documentation for Ek3516 will be undertaken by the Nevada State Museum in Carson City, Nevada.

Test Results

As elsewhere in areas immediately peripheral to the Tosawihi Quarries, "noise" contributed by a ubiquitous background scatter of opalite debitage rendered identification of site boundaries somewhat problematical. Following conventions established for testing of other sites in the area, surface artifact density and shared topographic context were used to isolate 26Ek3516 from amid the general background of debris and to distinguish it from other sites nearby.

Reduced artifact density along the brink of Mary's Ridge defines the boundary over the northern half of the site. Minor drainage channels accompanied by little detectable concomitant change in artifact density were adopted as boundaries on the southwest and northeast and they served to differentiate the site in these quarters from reduction stations of 26Ek3223 and 26Ek3515, respectively. On the south, subtle diminution of flake densities and a change in slope gradient arbitrarily distinguish the site from reduction station 26Ek3224 in Deer Pass. At its eastern limit, gradually decreasing artifact density of 26Ek3516 blends into the sparse lithic scatter that characterizes inter-locality areas in this portion of the Tosawihi Quarries (see Figure 21).

In non-feature contexts, close interval inspection and discretionary surface collection revealed formed artifacts to occur diffusely throughout the site within a light debitage scatter of between 15 and 35 flakes/m^2. Toolstone processing debris constitutes the bulk of the assemblage recovered, here, represented by twelve opalite bifaces, a basalt hammerstone, and a collection of opalite waste. Several implements indicative of maintenance/subsistence chores were encountered here as well, including two projectile points, a flake tool, and a mano. Table 13 summarized the cultural content of non-feature contexts and Table 15 presents the yields from DSC units.

Table 15. Discretionary Surface Collection from Nonfeature Contexts, Site 26Ek3516.

		DEBITAGE		FORMED ARTIFACTS		
Unit No.	Volume Excav. (m^3)	n	wt. (gm)	Bifaces	Flake Tools	Total
*2	0.02	24	15.7	-	-	0
3	0.02	35	38.5	-	-	1
4	0.02	15	14.5	-	1	1
5	0.02	18	28.5	1	-	1
Totals	0.08	92	97.2	1	1	2

*DSC Unit 1 served as surface scrape in Feature 2 (cf. Table 6.4)

South-facing ridgeslopes host the two cultural features at 26Ek3516 (see Figure 21). Both are reduction stations manifest by concentrations of opalite processing by-products created by spatially distinct episodes of biface manufacture. Feature 1, the larger, least dense of the features, occurs at the southern edge of the site immediately above Deer Pass. Known only from inventory procedures, it is defined by a 9 m^2 moderate density patch of opalite debitage. Only one formed artifact, a flake tool, was found on its surface (see Table 13). The smaller reduction station, Feature 2, occupies a slight flattening on the ridgeslope located about 35 m to the northeast. It is defined by a high density accumulation of opalite debitage and biface fragments scattered over 5 m^2. Our 1 m x 1 m surface scrape and congruent excavation unit returned an abundance of debitage accompanied by several bifaces and a pair of flake tools. All lithic spoils are opalite; no faunal remains, charcoal, or other cultural residues were returned. Subsurface work penetrated soils that are shallow, turbated, and lack cultural stratigraphy. Although artifactual remains occur throughout unit depths, excavation revealed that Feature 2 is confined almost exclusively to the upper 10 cm of the deposit. Below this only scant remains were encountered until andesitic basalt bedrock halted digging at a depth of ca. 25 cm (Table 16).

Table 16. Artifacts Recovered from Surface Scrapes and Excavation Unit 1, Feature 1, Site 26Ek3516.

		DEBITAGE				FORMED ARTIFACTS		
		Flakes		Shatter				
Level/Depth (cm B.S.)	Volume Excav. (m^3)	n	wt. (gm)	n	wt. (gm)	Bifaces	Flake Tools	Total
5 (0-2)	0.02	237	705.0	12	25.3	3	-	3
1 (2-10)	0.08	414	1658.4	15	274.7	1	-	1
2 (10-20)	0.10	195	303.6	-	-	1	1	2
3 (20-25)	0.05	5	0.7	-	-	-	1	1
Total	0.25	852	2667.7	27	300.0	5	2	7

The bulk of cultural material recovered by test samples from 26Ek3516, regardless of provenience, are referable directly to opalite processing. The reduction assemblage recovered from general site contexts is, save for its dispersed state, comparable to that which constitutes the cultural features (see Table 13). Analysis of the biface assemblage (n=17) coupled with cursory technological characterization of the debitage suggest that the place hosted nearly the full extent of the toolstone processing trajectory recorded for the Tosawihi vicinity: from blank preparation through late stage biface production (Bloomer and Ataman 1991). Of the 11 specimens for which reduction stage could be identified, most are the product of middle and late stage processing (mid Stage 3 and Stage 4; n=5 and n=2, respectively), two have undergone only initial primary thinning (early Stage 3), and one piece, a large flake, most likely represents a biface blank. Only two of the specimens are complete; the remainder are fragmentary results of manufacturing failures. Most of the bifaces (n=11) have been heat-treated.

Comprised as such, the processing component at 26Ek3516 is essentially identical to assemblages recovered from sites peripheral to the Tosawihi Quarries. It is noteworthy, however, for the uncommon variety of colorful, high quality opalites that comprise it. Differences in material color and texture suggest that contributions from as many as eight separate toolstone sources are represented in the collection. Most of these are of the distinctive polychrome cherts that are available from the quarry pit complexes of the Butterscotch Ridge Archaeological Neighborhood of 26Ek3032.

The scant remainder of the assemblage (weapons, groundstone, and flake tools) imply use of the site for purposes beyond the strict address of toolstone. The two projectile points recovered, one of obsidian and one of opalite, are both referable to Elko Corner-notched types on the basis of Thomas's (1981) key (see Figure 12). Their presence is plausibly attributable to an episode of hunters' re-tooling at the site . Both are fragmentary; their distal ends are truncated by impact fractures. The opalite specimen (01-9) was reworked and reused prior to its ultimate discard. All four of the flake tools in the collection are minimally used implements. Made on small opalite flakes, each displays minor unifacial retouch and they likely were selected from amid the lithic scatter for some expedient cutting, scraping, or graving task. The mano is complete (see Figure 17). It is made on an andesite cobble that, by means of intentional shaping and use, has been rendered oval in plan and biconvex in section. The full extent of both faces is ground and its margins are battered.

Implications

Tests at 26Ek3516 disclose site contents dominated by prolific waste products of opalite processing. These remains are augmented by a small number of maintenance/subsistence tools that may reflect activities ancillary to, but supportive of, toolstone production. Diversity of the assemblage aside, the diffuse distribution of cultural material coupled with the small size and depauperate formed artifact components of the two reduction features there suggest that the place saw comparatively ephemeral, less intensive use than did many more favorably provisioned sites in the vicinity (cf. Leach 1991).

Given its lack of primary toolstone supplies, great distance from water, and non-nutritious vegetation, factors conditioning aboriginal use of 26Ek3516 would appear to stem from its position relative resources lying beyond its limits rather than from any special offering available within the site itself. Indeed, the location of 26Ek3516 next to Deer Pass places it central to several off-site resources. Importantly, Deer Pass forms a natural causeway that joins the high quality toolstone prospects of the Tosawihi Quarries to the east with the opalite-scarce but bitterroot-rich uplands to the west (cf. Raven 1991a). The abundance of distinctively colorful cherts in the assemblage almost certainly originated from the quarries of Butterscotch Ridge. As well, deer are commonly seen in the immediate vicinity and have likely traversed the Pass for millennia when moving between the relatively abundant browse available in the riparian habitats that flank it. The projectile points at the site suggest that someone may have taken advantage of their passage sometime during the Middle Archaic. That the calories sought by these hunters and seed processors were destined to fuel efforts of opalite extraction and reduction is unknowable with certainty. Given the minimal attraction of Tosawihi for anything but stone however, we suspect that this was the case (cf. Raven 1991a).

In this light we suspect that the site's provision of commodious workspace, its location relative to toolstone resources nearby, and perhaps a seasonal opportunity to collect plant foods and take large game, inspired prehistoric visitation of the place.

National Register Evaluation

Testing of 26Ek3516 served as the basis for clarifying issues of its National Register eligibility. Upon completion of fieldwork and laboratory analyses, data garnered by testing were reviewed as a means of evaluating the NRHP significance of the site. The significance of the site resided in the degree to which test results promised that it contained information pertinent to the address of explicit research issues relevant to Tosawihi Quarries prehistory (Intermountain Research 1988a; Budy, Elston, and Raven 1989:13-37).

From this perspective, evaluations conclude that 26Ek3516 does not contain additional data that would contribute productively to the larger context of Tosawihi research. Although of minimal extent, testing seems assuredly to have recovered the full information content of the site. As such, 26Ek3516 is determined to be ineligible for nomination to the National Register. To wit, construction of the Main Access Road to Ivanhoe Gold Company's Hollister Mine will have no adverse effect on the site.

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APPENDIX A

Tephra Analysis

DESERT RESEARCH INSTITUTE
University of Nevada System

Quaternary Sciences Center

7010 Dandini Blvd.
Reno, Nevada 89512
P.O. Box 60220
Reno, Nevada 89506
(702) 673-7303

26 Sept., 1989

Dr. Robert Elston
Intermountain Research
Drawer D
Silver City NV 89428

Dear Bob,

I have examined the sediment samples (2599–128 and 2599–19, and the bag labelled 26EK3032–LOC. 26 -T1- 20) you gave me from the Tosawihi Quarry area and I conclude that they all contain Mazama tephra, from the 6800 yr B.P. eruption at Crater Lake, Oregon.

I took a few grams of each specimen and wetted them with dilute HCl; there was no reaction. I immersed the samples in an ultrasonic cleaner and decanted them repeatedly until the supernatant was fairly clear, to remove coatings and fine particles. I then dried the samples and examined a pinch of each in refractive index oil ($n = 1.508$) under a cover slip in transmitted light at magnifications of 100 to 400 X.

Sample -128 was about 50% clean glass and mineral fragments, the remainder being aggregates and coated grains. Sample -197 was about 10% clean glass and mineral fragments. Sample -20 was less than 5% glass, but several glass fragments were clearly visible. Each sample contained phytoliths. However, the clean glass and mineral fragments were essentially identical in the three specimens and the following description refers to all three.

Glass morphology was vesicular with vesicles predominantly stretched into spindle shapes. Fine glass was platy, or bubble-wall, in shape. The refractive index of the hydrated glass was very slightly less than 1.508, perhaps 1.5075, and hydration rinds about 3.5 micrometers thick were distinctly visible on thin particles. Green to brown hornblende with adhering glass was present in both -197 and -128.

Although these techniques are cursory, the combination of stratigraphic and geographic setting, and the limited number of possible tephra layers in the area allow me to conclude that the glass in these samples represents the Mazama tephra. Tephra more than 10,000 or 15,000 years old would be completely hydrated and would not display hydration rinds (this applies to ash derived from the Tertiary bedrock, as well). No tephra between 6,800 and 19,000 years old are known from northern Nevada, except the Mazama tephra. Younger tephra would have thinner rinds and the possible candidates (Newberry and Mono Craters) have distinctly lower refractive indices than the samples you provided.

Sincerely,

Jonathan

Dr. Jonathan O. Davis
Research Professor

APPENDIX B

Provenience of Cultural Materials 26Ek3032, Locality 27

Provenience of Cultural Materials, 26Ek3032, Locality 27

LEVEL	PROJ. PTS.	PREFORMS	BIFACES	FLAKE TOOLS	MOD. CHUNK	HAMMERS	CHOPPERS	CORES	GROUNDSTONE	POTTERY	MISC.	HISTORICAL	TOTAL
Surface													
0	2	0	127	14	3	6		9	6				167
EU1													
0												1	1
1	1		6	2								1	10
2			12	1	2								15
3			5		1								6
4			2										2
5													0
subtotal	1	0	25	3	3	0	0	0	0	0	0	2	34
EU2													
0			1									11	12
1			5										5
2			7		2								9
3			4		1						bead		6
4													0
5													0
subtotal	0	0	17	0	3	0	0	0	0	0	1	11	32
EU3													
0													0
1													0

(cont.)

Provenience of Cultural Materials, 26Ek3032, Locality 27

LEVEL	PROJ. PTS.	PREFORMS	BIFACES	FLAKE TOOLS	MOD. CHUNK	HAMMERS	CHOPPERS	CORES	GROUNDSTONE	POTTERY	MISC.	HISTORICAL	TOTAL
2													0
3													0
4													0
5													0
subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0
EU4													
0			2	1								11	14
1			2		1					1		7	11
2	1		1										2
3			7	1									8
4													0
5					1								1
subtotal	1	0	12	2	2	0	0	0	0	1	0	18	36
EU4 1/8"													
0			2	1								16	19
1			1	1	1							1	4
2			3		1								4
3			1										1
4													0
5													0
subtotal	0	0	7	2	2	0	0	0	0	0	0	17	28
EU5													
0												35	35

(cont.)

Provenience of Cultural Materials, 26Ek3032, Locality 27

LEVEL	PROJ. PTS.	PREFORMS	BIFACES	FLAKE TOOLS	MOD. CHUNK	HAMMERS	CHOPPERS	CORES	GROUNDSTONE	POTTERY	MISC.	HISTORICAL	TOTAL
1												7	7
2			10	3	1						bone bead		15
3			2										2
4			2										2
5			3										3
6													0
7			2										2
subtotal	0	0	19	3	1	0	0	0	0	0	1	42	66
EU6													
0			1										1
1				1								1	2
2			1		1								2
3			3										3
4			1	1				1					3
5			1										1
6													0
subtotal	0	0	7	2	1	0	0	1	0	0	0	1	12
EU7													
0			1										1
1			2										2
2	1												1
3													0
4													0
5													0
6													0

(cont.)

Provenience of Cultural Materials, 26Ek3032, Locality 27

LEVEL	PROJ. PTS.	PREFORMS	BIFACES	FLAKE TOOLS	MOD. CHUNK	HAMMERS	CHOPPERS	CORES	GROUNDSTONE	POTTERY	MISC.	HISTORICAL	TOTAL
7													0
8													0
9			2		1								3
10													0
11													0
subtotal	1	0	5	0	1	0	0	0	0	0	0	0	7
EU8													
0													0
1													0
2			1										1
3		2											2
4													0
5			1										1
6													0
subtotal	0	2	2	0	0	0	0	0	0	0	0	0	4
EU8 1/8"													
0													0
1													0
2													0
3													0
4													0
5													0
6													0
subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0

(cont.)

Provenience of Cultural Materials, 26Ek3032, Locality 27

LEVEL	PROJ. PTS.	PREFORMS	BIFACES	FLAKE TOOLS	MOD. CHUNK	HAMMERS	CHOPPERS	CORES	GROUNDSTONE	POTTERY	MISC.	HISTORICAL	TOTAL
EU9													
0			2										2
1			2										2
2			3	1						5			9
3			2	1				1		1			5
4													0
5				1		1							2
6			1										1
7				1		1							2
8													0
9													0
10													0
subtotal	0	0	10	4	0	2	0	1	0	6	0	0	23
EU 10													
0													0
1								1					1
2		1											1
subtotal	0	1	0	0	0	0	0	1	0	0	0	0	2
EU 11													
0				1									1
1			1										1
2			5	1									6
3			1										1
subtotal	0	0	7	2	0	0	0	0	0	0	0	0	9

(cont.)

Provenience of Cultural Materials, 26Ek3032, Locality 27

LEVEL	PROJ. PTS.	PREFORMS	BIFACES	FLAKE TOOLS	MOD. CHUNK	HAMMERS	CHOPPERS	CORES	GROUNDSTONE	POTTERY	MISC.	HISTORICAL	TOTAL
EU 12													
0													0
1			2										2
2			3		1								4
3													0
4													0
subtotal	0	0	5	0	1	0	0	0	0	0	0	0	6
EU 13													
0			1									1	2
1			1										1
2			1										1
3			2										2
4			1		1								2
subtotal	0	0	6	0	1	0	0	0	0	0	0	1	8
EU 18													
0													0
1													0
2													0
3			1.										1
4													0
5													0
subtotal	0	0	1	0	0	0	0	0	0	0	0	0	1

(cont.)

Provenience of Cultural Materials, 26Ek3032, Locality 27

LEVEL	PROJ. PTS.	PREFORMS	BIFACES	FLAKE TOOLS	MOD. CHUNK	HAMMERS	CHOPPERS	CORES	GROUNDSTONE	POTTERY	MISC.	HISTORICAL	TOTAL
EU 19													
0		1	1							1			3
1	1			1						3			5
2			3										3
3			1										1
4													0
5			1										1
subtotal	1	1	6	1	0	0	0	0	0	4	0	0	13
EU 20													
0													0
1									1				1
2			1		1	1							3
3			1										1
4													0
5													0
6													0
7			2										2
8				1									1
9			1										1
10													0
11								1					1
12													0
13													0
14													0
subtotal	0	0	5	1	1	1	0	1	1	0	0	0	10

(cont.)

Provenience of Cultural Materials, 26Ek3032, Locality 27

LEVEL	PROJ. PTS.	PREFORMS	BIFACES	FLAKE TOOLS	MOD. CHUNK	HAMMERS	CHOPPERS	CORES	GROUNDSTONE	POTTERY	MISC.	HISTORICAL	TOTAL
EU 21													
0													0
1	1												1
2													0
3													0
subtotal	1	0	0	0	0	0	0	0	0	0	0	0	1
EU 23													
0													0
1													0
2			2	1									3
3													0
4													0
subtotal	0	0	2	1	0	0	0	0	0	0	0	0	3
EU 25													
0													0
1			2										2
2				1									1
3			3					1					4
4			1										1
subtotal	0	0	6	1	0	0	0	1	0	0	0	0	8
EU 27													
0		1											1
1	1		4	1									6

(cont.)

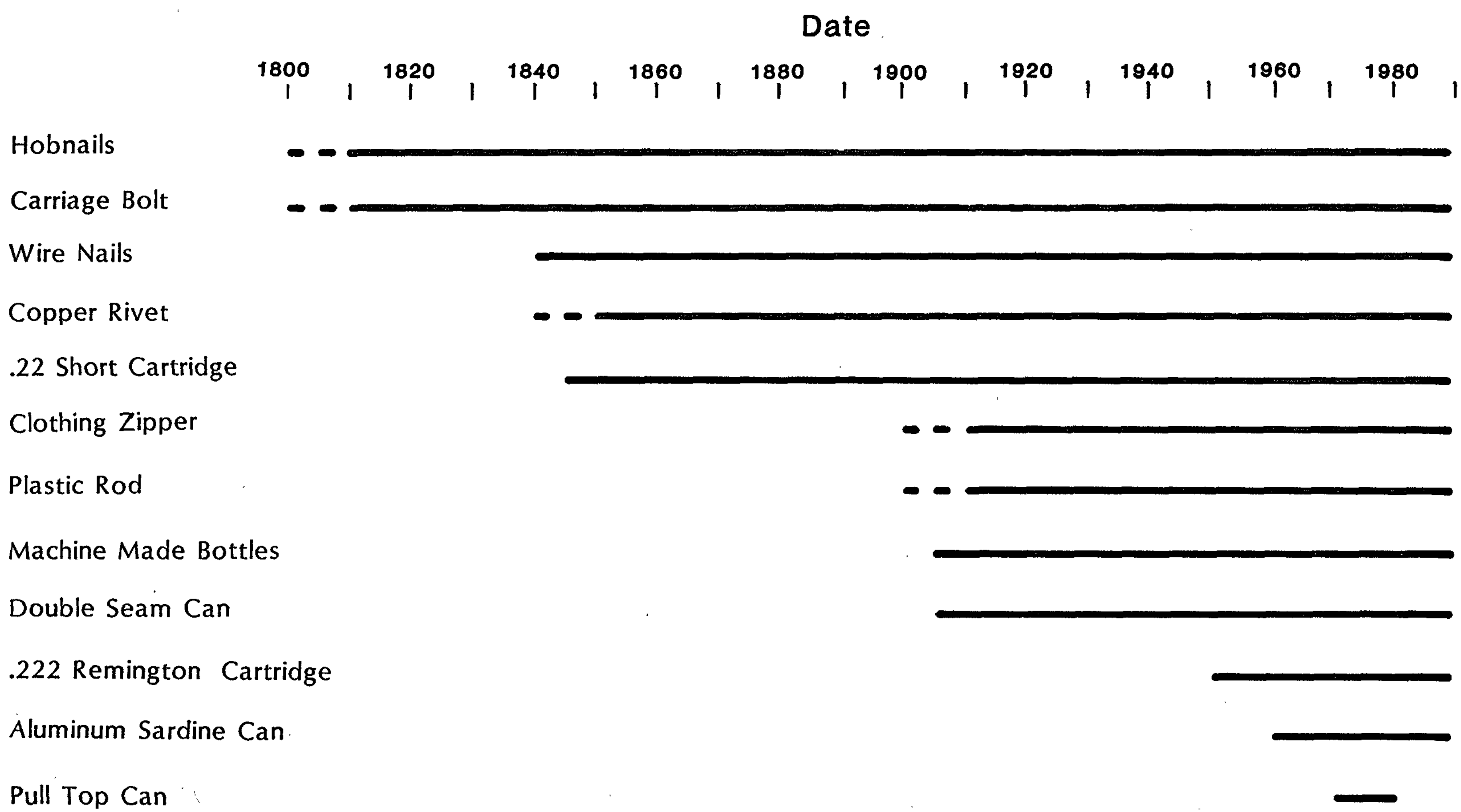
Provenience of Cultural Materials, 26Ek3032, Locality 27

LEVEL	PROJ. PTS.	PREFORMS	BIFACES	FLAKE TOOLS	MOD. CHUNK	HAMMERS	CHOPPERS	CORES	GROUNDSTONE	POTTERY	MISC.	HISTORICAL	TOTAL
2			5										5
3													0
4				1									1
5													0
subtotal	1	1	9	2	0	0	0	0	0	0	0	0	13
TOTAL	8	5	278	38	19	9	0	14	7	11	2	92	483

APPENDIX C

Temporal Span of Historic Artifacts 26Ek3032, Locality 27

26Ek3032 Locality 27



APPENDIX D

Morphological Attributes of Projectile Points and Preforms, 26Ek3032, Locality 27

Morphological Attributes of Projectile Points and Preforms.

Ref. #	Type	Locality	Unit	Level	Depth	Material	Lt	La	Lm	Wm	Wb	NW	Th	Act Wt	Est Wt	DSA	PSA	NOI	La/Lt	Lt/Wm	Wb/Wm	Comp
6062-2	GSS	27	Eu4	2	10-20	Opalite	(34.6)	(30.4)	9.5	26.2	12.4	12.2	3.7	2.7	3.0	140	94	44	.88	1.32	.43	-
01-130	LSN	27	1a	Surf		Obsidian	(44.0)	(44.0)		(19.5)	(19.5)	10.0	4.1	2.0	2.5	190	(162)	(28)	1.00	2.26	1.00	-
6521-1	OOK (Cottonwood)	27	Eu27	1	2-10	Obsidian	18.6	18.6	8.5	9.6	7.2	6.5	2.0	.4	.4	227	103	124	1.00	1.94	.75	+
01-45	OOK (Stemmed)	27	1a	Surf		Opalite	41.3			17.5			5.2	3.9								-
6401-1	OOK	27	Eu21	1	2-10	Opalite	45.1	43.4	5.1	22.4	21.9		4.5	2.4	5.0				.96	2.01	.98	-
6122-1	Fragment	27	Eu7	2	10-20	Opalite	33.2			22.8			3.5	2.2								
6143-1	Fragment	27	Eu8	3	20-30	Opalite	16.0			21.5			4.3	2.1								
6361-6	Fragment	27	Eu19	1	2-10	Opalite	11.9			7.9			1.4	.2								
6143-2	Preform	27	Eu8	3	20-30	Opalite	31.6			21.5			4.0	2.6								-
6520-1	Preform	27	Eu27	Surf	0-2	Opalite	26.4			19.1			4.5	2.4								-
6360-5	Preform	27	Eu19	Surf	0-2	Opalite	22.7			14.8			2.7	.8								-
6182-2	Preform	27	Eu10	2	10-20	Opalite	20.4			17.2			3.2	1.3								-
01-96	Preform	27	1a	Surf		Obsidian	24.8			15.0			3.6	1.4								+

Key:

GSS = Gatecliff Split Stem
LSN = Large Side-Notch
OOK = Out of Key

Lt = Total Length
La = Axial Length
Lm = Length Max. Width
Wm = Maximum Width
Wb = Basal Width
NW = Neck Width
Th = Thickness

Act Wt = Actual Weight
Est Wt = Estimated Weight
DSA = Distal Shoulder Angle
PSA = Proximal Shoulder Angle
NOI = Notch Opening Index
La/Lt = Basal Indentation Ration (BIR)
Lt/Wm = Length-Width Ratio
Wb/Wm = Basal Width-Maximum Width Ratio

Comp = Completeness
\+ Complete
\- Fragment

APPENDIX E

Radiocarbon Results, 26Ek3032, Locality 26

BETA ANALYTIC INC.

RADIOCARBON DATING, STABLE ISOTOPE RATIOS
P.O. BOX 248113 CORAL GABLES, FLORIDA 33124 - (305) 667-5167
BITNET XNRBET22@SERVAX

March 5, 1990

Mr. Steven G. Botkin
Intemountain Research
Drawer A
Silver City, Nevada 89428

Dear Mr. Botkin:

Please find enclosed the result on the charcoal sample recently submitted for radiocarbon dating analysis. We hope this date will be useful in your research.

Your charcoal was pretreated by first examining for rootlets. The sample was then given a hot acid wash to eliminate carbonates. It was repeatedly rinsed to neutrality and subsequently given a hot alkali soaking to take out humic acids. After rinsing to neutrality, another acid wash followed and another rinsing to neutrality. The following benzene synthesis and counting proceeded normally.

The sample was small, as indicated on the date report sheet. It was given extended counting time (four times the normal amount) to reduce the statistical error as much as practical.

We are enclosing our invoice. If there are any questions or if you would like to confer on the date, my direct telephone number is listed above. Both my partner and I have over thirty years experience in radiocarbon dating. Please don't hesitate to call us if we can be of help.

Sincerely yours,

Murry Tamers

Murry Tamers, Ph.D.
Co-director

P.S. I'm including some data sheets for future samples and a copy of our new brochure for your files.

BETA ANALYTIC INC.
(305) 667-5167
UNIVERSITY BRANCH
P.O. BOX 248113
CORAL GABLES, FLA. 33124

REPORT OF RADIOCARBON DATING ANALYSES

FOR: Steven G. Botkin
Intermountain Research

DATE RECEIVED: February 7, 1990
DATE REPORTED: March 5, 1990
SUBMITTER'S PURCHASE ORDER #

OUR LAB NUMBER	YOUR SAMPLE NUMBER	C-14 AGE YEARS B.P. ±1σ	
Beta-35573	26EK3032 Loc 26 2599-196 (0.35 gram carbon)	510 +/- 80 BP	(charcoal)

Note: the small sample was given extended counting time.

These dates are reported as RCYBP (radiocarbon years before 1950 A.D.). By international convention, the half-life of radiocarbon is taken as 5568 years and 95% of the activity of the National Bureau of Standards Oxalic Acid (original batch) used as the modern standard. The quoted errors are from the counting of the modern standard, background, and sample being analyzed. They represent one standard deviation statistics (68% probability), based on the random nature of the radioactive disintegration process. Also by international convention, no corrections are made for DeVries effect, reservoir effect, or isotope fractionation in nature, unless specifically noted above. Stable carbon ratios are measured on request and are calculated relative to the PDB-1 international standard; the adjusted ages are normalized to -25 per mil carbon 13.

APPENDIX F

Mass Analysis Results, by Excavation Unit, 26Ek3032, Locality 27

Debitage Summary, 26EK3032, Locality 27

EU Number	Depth B.S. (cm)	Cubic meters excavated	Raw material type	Total flakes recovered count	Total flakes recovered weight (g)	Flakes w/platfm count	Flakes w/platfm weight (g)	Flake fragments count	Flake fragments weight (g)	Mass Analysis Classification
1	0-2	0.02	Opalite	248	324.9	76	182.9	172	142.0	Early Biface
1	0-2	0.02	Jasper	2	0.6	0	0.0	2	0.6	Not classified
1	2-10	0.08	Opalite	886	1300.2	292	673.7	594	626.5	Early Biface
1	2-10	0.08	Jasper	1	0.1	0	0.0	1	0.1	Not classified
1	10-20	0.10	Opalite	758	1739.8	271	991.2	487	748.6	Early Biface
1	10-20	0.10	Obsidian	1	0.2	0	0.0	1	0.2	Not classified
1	20-30	0.10	Opalite	202	785.4	69	431.9	133	353.5	Early Biface
1	20-30	0.10	Other	1	77.9	1	77.9	0	0.0	Not classified
1	30-40	0.10	Opalite	83	349.2	30	236.6	53	112.6	Early Biface
1	30-40	0.10	Jasper	2	118.6	1	117.2	1	1.4	Not classified
1	40-50	0.10	Opalite	17	32.3	9	25.1	8	7.2	Not classified
2	0-2	0.02	Opalite	292	321.2	201	141.0	91	180.2	Early Biface
2	2-10	0.08	Opalite	644	952.6	223	461.9	421	490.7	Early Biface
2	2-10	0.08	Jasper	9	7.4	5	5.8	4	1.6	Not classified
2	10-20	0.10	Opalite	556	1179.2	210	299.4	346	879.8	Early Biface
2	10-20	0.10	Jasper	6	21.8	2	2.1	4	19.7	Not classified
2	20-30	0.10	Opalite	399	1530.1	80	871.3	319	658.8	Early Biface
2	20-30	0.10	Jasper	3	1.2	0	0.0	3	1.2	Not classified
2	30-40	0.10	Opalite	68	180.1	26	74.8	42	105.3	Early Biface
2	40-50	0.10	Opalite	64	69.1	28	47.5	36	21.6	Early Biface
3	0-2	0.02	Opalite	10	20.9	2	17.5	8	3.4	Not classified
3	2-10	0.08	Opalite	9	9.7	3	4.4	6	5.3	Not classified
3	10-20	0.10	Opalite	40	101.9	20	77.3	20	24.6	Not classified
3	20-30	0.10	Opalite	34	82.6	13	68.3	21	14.3	Not classified
3	30-40	0.10	Opalite	60	59.4	12	17.5	48	41.9	Mixed Biface
3	40-50	0.10	Opalite	5	19.2	1	16.9	4	2.3	Not classified
4	0-2	0.02	Opalite	254	189.3	137	106.9	117	82.4	Early Biface
4	2-10	0.08	Opalite	801	1455.4	253	655.4	548	800.0	Early Biface
4	2-10	0.08	Jasper	9	7.3	3	1.9	6	5.4	Not classified
4	10-20	0.10	Opalite	825	2388.2	310	1553.8	515	834.4	Early Biface
4	10-20	0.10	Jasper	0	0.0	0	0.0	0	0.0	Not classified
4	20-30	0.10	Opalite	528	589.8	234	321.8	294	268.0	Early Biface
4	20-30	0.10	Obsidian	1	0.1	0	0.0	1	0.1	Not classified
4	30-40	0.10	Opalite	222	203.1	72	63.1	150	140.0	Early Biface

(cont.)

Debitage Summary, 26EK3032, Locality 27

EU Number	Depth B.S. (cm)	Cubic meters excavated	Raw material type	Total flakes recovered count	Total flakes recovered weight (g)	Flakes w/platfm count	Flakes w/platfm weight (g)	Flake fragments count	Flake fragments weight (g)	Mass Analysis Classification
4	40-50	0.07	Opalite	174	269.4	49	130.5	125	138.9	Early Biface
5	0-2	0.02	Opalite	161	208.2	45	80.3	116	127.9	Early Biface
5	0-2	0.02	Jasper	1	0.4	0	0.0	1	0.4	Not classified
5	2-10	0.08	Opalite	351	456.8	138	283.5	213	173.3	Early Biface
5	10-20	0.02	Opalite	1295	3924.3	430	1802.8	865	2121.5	Early Biface
5	10-20	0.02	Jasper	17	7.2	8	3.8	9	3.4	Not classified
5	20-30	0.08	Opalite	388	918.7	140	577.0	248	341.7	Early Biface
5	20-30	0.08	Jasper	5	2.3	0	0.0	5	2.3	Not classified
5	20-30	0.08	Other	1	0.3	1	0.3	0	0.0	Not classified
5	30-40	0.10	Opalite	371	1182.6	164	972.8	207	209.8	Early Biface
5	30-40	0.10	Jasper	3	0.6	3	0.6	0	0.0	Not classified
5	40-50	0.10	Opalite	218	763.1	80	258.5	138	504.6	Early Biface
5	40-50	0.10	Jasper	4	3.8	1	0.8	3	3.0	Not classified
5	50-60	0.10	Opalite	259	340.0	94	210.9	165	129.1	Early Biface
5	50-60	0.10	Jasper	3	1.9	1	0.2	2	1.7	Not classified
5	60-70	0.10	Opalite	170	192.6	72	73.9	98	118.7	Early Biface
6	0-2	0.02	Opalite	132	124.7	33	37.0	99	87.7	Early Biface
6	0-2	0.02	Jasper	3	3.1	1	2.6	2	0.5	Not classified
6	2-10	0.08	Opalite	362	362.8	86	119.3	276	243.5	Early Biface
6	2-10	0.08	Jasper	2	1.5	2	1.5	0	0.0	Not classified
6	10-20	0.10	Opalite	535	651.9	120	220.3	415	431.6	Early Biface
6	10-20	0.10	Jasper	5	1.5	1	0.3	4	1.2	Not classified
6	10-20	0.10	Other	0	0.0	0	0.0	0	0.0	Not classified
6	20-30	0.10	Opalite	299	483.4	60	152.7	239	330.7	Early Biface
6	30-40	0.10	Opalite	236	345.0	70	158.0	166	187.0	Early Biface
6	30-40	0.10	Jasper	2	0.9	2	0.9	0	0.0	Not classified
6	40-50	0.10	Opalite	236	405.1	79	221.9	157	183.2	Early Biface
6	40-50	0.10	Other	0	0.0	0	0.0	0	0.0	Not classified
6	50-60	0.10	Opalite	106	219.7	21	16.2	85	203.5	Early Biface
6	50-60	0.10	Jasper	2	2.3	1	2.0	1	0.3	Not classified
7	0-2	0.02	Opalite	41	46.3	10	15.6	31	30.7	Not classified
7	2-10	0.08	Opalite	98	183.3	51	111.2	47	72.1	Early Biface
7	10-20	0.10	Opalite	103	195.2	40	109.8	63	85.4	Early Biface
7	10-20	0.10	Other	0	0.0	0	0.0	0	0.0	Not classified

(cont.)

Debitage Summary, 26EK3032, Locality 27

EU Number	Depth B.S. (cm)	Cubic meters excavated	Raw material type	Total flakes recovered count	Total flakes recovered weight (g)	Flakes w/platfm count	Flakes w/platfm weight (g)	Flake fragments count	Flake fragments weight (g)	Mass Analysis Classification
7	20-30	0.10	Opalite	92	175.1	25	43.4	67	131.7	Early Biface
7	20-30	0.10	Other	0	0.0	0	0.0	0	0.0	Not classified
7	30-40	0.10	Opalite	116	342.8	35	266.1	81	76.7	Early Biface
7	30-40	0.10	Other	0	0.0	0	0.0	0	0.0	Not classified
7	40-50	0.10	Opalite	166	372.7	51	188.1	115	184.6	Early Biface
7	50-60	0.10	Opalite	128	239.0	35	99.8	93	139.2	Early Biface
7	50-60	0.10	Other	0	0.0	0	0.0	0	0.0	Not classified
7	60-70	0.10	Opalite	71	80.7	29	55.1	42	25.6	Early Biface
7	60-70	0.10	Other	0	0.0	0	0.0	0	0.0	Not classified
7	70-80	0.10	Opalite	60	180.9	22	134.6	38	46.3	Early Biface
7	80-90	0.10	Opalite	108	296.5	44	187.6	64	108.9	Early Biface
7	90-100	0.10	Opalite	70	136.3	17	76.7	53	59.6	Early Biface
7	100-110	0.09	Opalite	102	134.4	34	66.5	68	67.9	Early Biface
8	2-10	0.08	Opalite	96	121.0	28	65.1	68	55.9	Early Biface
8	10-20	0.10	Opalite	372	560.4	89	292.6	283	267.8	Early Biface
8	20-30	0.10	Opalite	274	1006.8	103	583.0	171	423.8	Early Biface
8	30-40	0.10	Opalite	133	280.2	49	106.3	84	173.9	Early Biface
8	40-50	0.10	Opalite	138	157.1	52	64.2	86	92.9	Early Biface
8	50-60	0.10	Opalite	99	297.7	35	206.1	64	91.6	Early Biface
9	0-2	0.02	Opalite	101	220.1	36	37.2	65	182.9	Early Biface
9	2-10	0.08	Opalite	881	781.2	172	358.0	709	423.2	Early Biface
9	10-20	0.10	Opalite	908	881.4	248	404.1	660	477.3	Early Biface
9	10-20	0.10	Jasper	2	2.2	1	0.4	1	1.8	Not classified
9	10-20	0.10	Basalt	1	0.4	0	0.0	1	0.4	Not classified
9	20-30	0.10	Opalite	384	762.2	130	523.9	254	238.3	Early Biface
9	30-40	0.10	Opalite	178	267.3	62	115.3	116	152.0	Early Biface
9	40-50	0.10	Opalite	217	288.2	78	137.1	139	151.1	Early Biface
9	50-60	0.10	Opalite	97	90.3	34	26.7	63	63.6	Early Biface
9	60-70	0.10	Opalite	112	186.5	38	113.6	74	72.9	Early Biface
9	70-80	0.10	Opalite	119	328.3	35	131.9	84	196.4	Early Biface
9	80-90	0.10	Opalite	84	101.0	31	63.9	53	37.1	Mixed Biface
9	90-100	0.10	Opalite	34	81.3	17	69.4	17	11.9	Not classified
10	0-2	0.02	Opalite	21	34.9	3	4.6	18	30.3	Not classified
10	2-10	0.08	Opalite	28	108.9	15	101.8	13	7.1	Not classified

(cont.)

Debitage Summary, 26EK3032, Locality 27

EU Number	Depth B.S. (cm)	Cubic meters excavated	Raw material type	Total flakes recovered count	Total flakes recovered weight (g)	Flakes w/platfm count	Flakes w/platfm weight (g)	Flake fragments count	Flake fragments weight (g)	Mass Analysis Classification
10	10-20	0.10	Opalite	27	113.7	17	108.0	10	5.7	Not classified
11	0-2	0.02	Opalite	57	62.7	20	23.7	37	39.0	Early Biface
11	2-10	0.08	Opalite	155	201.0	0	0.0	155	201.0	Early Biface
11	10-20	0.10	Opalite	398	795.5	172	461.4	226	334.1	Early Biface
11	20-30	0.10	Opalite	73	184.5	50	97.8	23	86.7	Early Biface
12	0-2	0.02	Opalite	19	69.3	4	31.1	15	38.2	Not classified
12	2-10	0.08	Opalite	74	75.8	40	56.7	34	19.1	Mixed Biface
12	10-20	0.10	Opalite	325	452.7	139	337.3	186	115.4	Early Biface
12	10-20	0.10	Jasper	1	24.2	1	24.2	0	0.0	Not classified
12	20-30	0.10	Opalite	181	304.2	80	239.4	101	64.8	Early Biface
12	30-40	0.10	Opalite	88	253.3	41	225.7	47	27.6	Early Biface
13	0-2	0.02	Opalite	94	79.2	16	21.6	78	57.6	Mixed Biface
13	0-2	0.02	Jasper	1	0.9	1	0.9	0	0.0	Not classified
13	2-10	0.08	Opalite	206	334.1	67	161.8	139	172.3	Early Biface
13	10-20	0.10	Opalite	341	451.1	154	265.8	187	185.3	Early Biface
13	20-30	0.10	Opalite	176	262.9	62	172.6	114	90.3	Early Biface
13	20-30	0.10	Jasper	0	0.0	0	0.0	0	0.0	Not classified
13	30-40	0.10	Opalite	58	565.7	28	523.7	30	42.0	Early Biface
18	0-2	0.02	Opalite	34	61.2	5	32.4	29	28.8	Not classified
18	2-10	0.08	Opalite	97	136.5	22	40.1	75	96.4	Early Biface
18	10-20	0.10	Opalite	62	94.8	11	15.6	51	79.2	Early Biface
18	20-30	0.10	Opalite	79	150.1	10	28.0	69	122.1	Early Biface
18	30-40	0.10	Opalite	44	168.6	8	66.7	36	101.9	Not classified
18	40-50	0.04	Opalite	49	97.9	6	4.3	43	93.6	Not classified
19	0-2	0.02	Opalite	114	214.9	28	43.2	86	171.7	Early Biface
19	2-10	0.08	Opalite	731	1581.2	273	1022.8	458	558.4	Early Biface
19	10-20	0.10	Opalite	806	2297.8	317	1535.0	489	762.8	Early Biface
19	20-30	0.10	Opalite	147	197.7	74	124.5	73	73.2	Early Biface
19	30-40	0.10	Opalite	72	82.8	28	34.9	44	47.9	Early Biface
19	40-50	0.10	Opalite	29	28.2	8	13.6	21	14.6	Not classified
20	0-2	0.02	Opalite	63	118.4	26	38.6	37	79.8	Early Biface

(cont.)

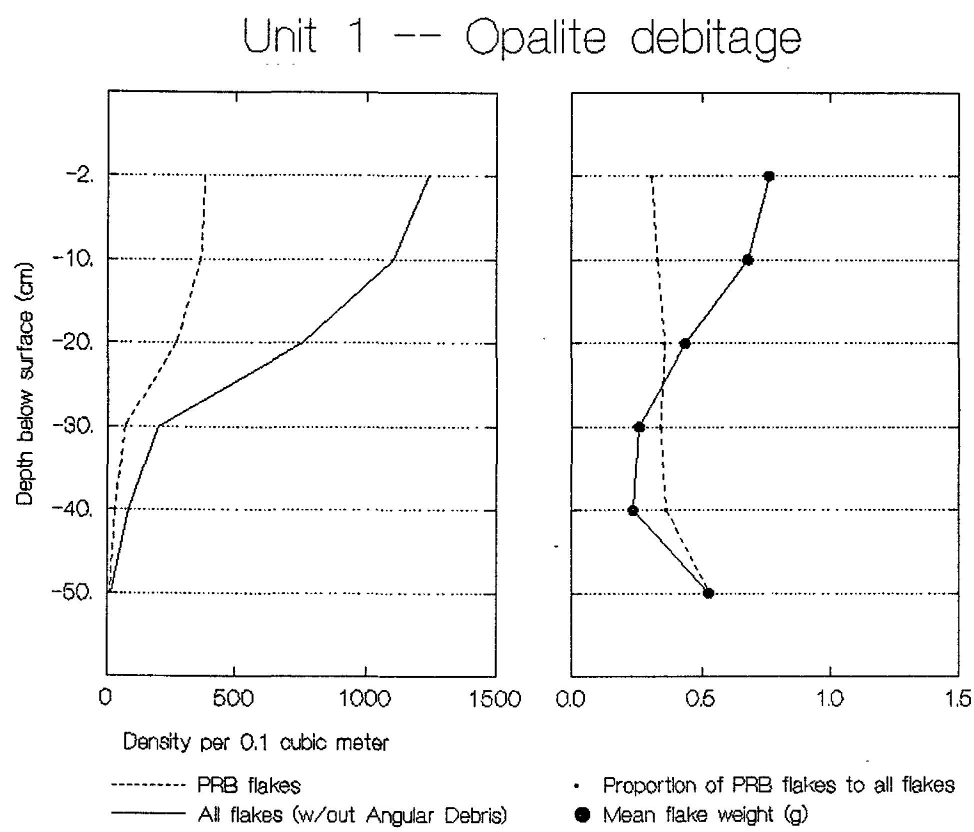
Debitage Summary, 26EK3032, Locality 27

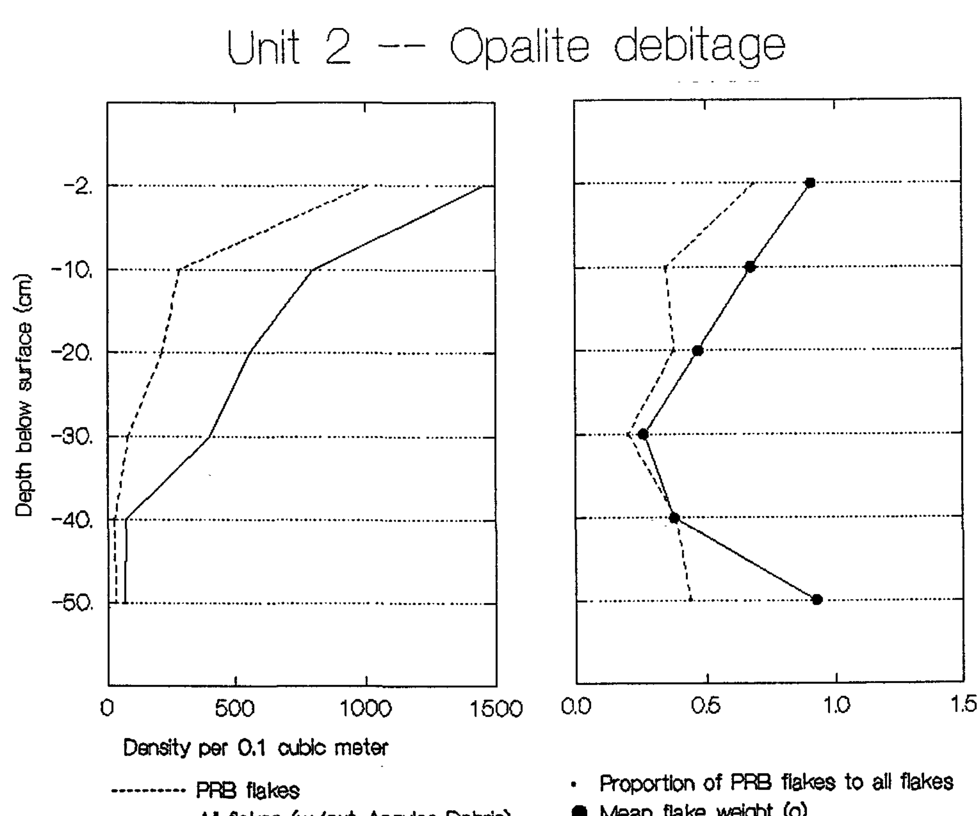
EU Number	Depth B.S. (cm)	Cubic meters excavated	Raw material type	Total flakes recovered count	Total flakes recovered weight (g)	Flakes w/platfm count	Flakes w/platfm weight (g)	Flake fragments count	Flake fragments weight (g)	Mass Analysis Classification
20	2-10	0.08	Opalite	409	524.0	106	183.6	303	340.4	Early Biface
20	2-10	0.08	Jasper	0	0.0	0	0.0	0	0.0	Not classified
20	10-20	0.10	Opalite	312	452.5	103	291.1	209	161.4	Early Biface
20	10-20	0.10	Jasper	0	0.0	0	0.0	0	0.0	Not classified
20	20-30	0.10	Opalite	342	616.0	132	381.9	210	234.1	Early Biface
20	20-30	0.10	Jasper	0	0.0	0	0.0	0	0.0	Not classified
20	30-40	0.10	Opalite	204	456.8	77	321.8	127	135.0	Early Biface
20	40-50	0.10	Opalite	172	644.2	67	512.1	105	132.1	Early Biface
20	50-60	0.10	Opalite	150	375.0	54	223.2	96	151.8	Early Biface
20	60-70	0.10	Opalite	117	106.1	28	24.2	89	81.9	Mixed Biface
20	60-70	0.10	Other	0	0.0	0	0.0	0	0.0	Not classified
20	70-80	0.10	Opalite	66	420.0	29	364.7	37	55.3	Early Biface
20	80-90	0.10	Opalite	75	148.6	15	70.6	60	78.0	Early Biface
20	90-100	0.10	Opalite	46	170.6	22	143.3	24	27.3	Not classified
20	100-110	0.10	Opalite	59	64.5	25	42.1	34	22.4	Early Biface
20	110-120	0.10	Opalite	40	140.7	25	116.6	15	24.1	Not classified
20	120-130	0.10	Opalite	26	46.0	4	4.5	22	41.5	Not classified
20	130-140	0.10	Opalite	8	62.5	7	47.9	1	14.6	Not classified
21	0-2	0.02	Opalite	121	104.6	30	31.9	91	72.7	Mixed Biface
21	2-10	0.08	Opalite	141	102.4	42	26.8	99	75.6	Early Biface
21	2-10	0.08	Jasper	3	2.6	2	2.2	1	0.4	Not classified
21	10-20	0.10	Opalite	110	130.5	27	46.1	83	84.4	Early Biface
21	10-20	0.10	Jasper	1	0.4	1	0.4	0	0.0	Not classified
21	20-30	0.10	Opalite	28	202.4	9	171.3	19	31.1	Not classified
23	0-2	0.02	Opalite	23	21.8	19	20.0	4	1.8	Not classified
23	2-10	0.08	Opalite	120	96.4	29	30.9	91	65.5	Mixed Biface
23	2-10	0.08	Jasper	1	0.2	0	0.0	1	0.2	Not classified
23	10-20	0.10	Opalite	179	264.1	62	162.8	117	101.3	Early Biface
23	10-20	0.10	Jasper	1	0.4	0	0.0	1	0.4	Not classified
23	20-30	0.10	Opalite	66	74.1	20	40.8	46	33.3	Early Biface
23	20-30	0.10	Jasper	1	0.2	1	0.2	0	0.0	Not classified
23	30-40	0.10	Opalite	27	32.1	9	24.7	18	7.4	Not classified
23	30-40	0.10	Jasper	1	0.4	1	0.4	0	0.0	Not classified
25	0-2	0.02	Opalite	6	1.7	1	0.2	5	1.5	Not classified

(cont.)

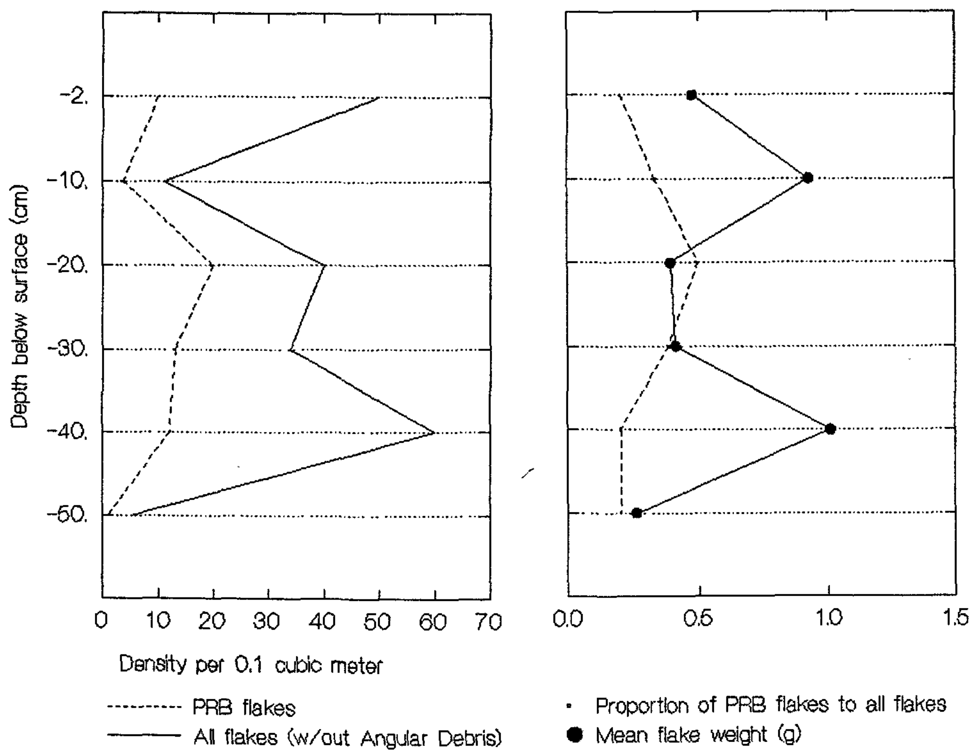
Debitage Summary, 26EK3032, Locality 27

EU Number	Depth B.S. (cm)	Cubic meters excavated	Raw material type	Total flakes recovered count	Total flakes recovered weight (g)	Flakes w/platfm count	Flakes w/platfm weight (g)	Flake fragments count	Flake fragments weight (g)	Mass Analysis Classification
25	2-10	0.08	Opalite	23	34.8	10	21.3	13	13.5	Not classified
25	10-20	0.10	Opalite	64	260.8	18	145.9	46	114.9	Early Biface
25	20-30	0.10	Opalite	75	402.2	23	210.6	52	191.6	Early Biface
25	20-30	0.10	Jasper	1	0.4	1	0.4	0	0.0	Not classified
25	30-40	0.10	Opalite	74	534.1	25	457.8	49	76.3	Early Biface
27	0-2	0.02	Opalite	65	38.4	20	17.2	45	21.2	Mixed Biface
27	2-10	0.08	Opalite	394	519.7	125	167.1	269	352.6	Early Biface
27	2-10	0.08	Jasper	3	5.3	1	4.5	2	0.8	Not classified
27	10-20	0.10	Opalite	484	465.9	158	240.4	326	225.5	Early Biface
27	10-20	0.10	Jasper	8	4.4	5	2.7	3	1.7	Not classified
27	10-20	0.10	Other	0	0.0	0	0.0	0	0.0	Not classified
27	20-30	0.10	Opalite	77	96.3	19	21.8	58	74.5	Early Biface
27	30-40	0.10	Opalite	70	87.2	18	37.8	52	49.4	Mixed Biface
27	40-50	0.10	Opalite	18	30.9	9	17.2	9	13.7	Not classified

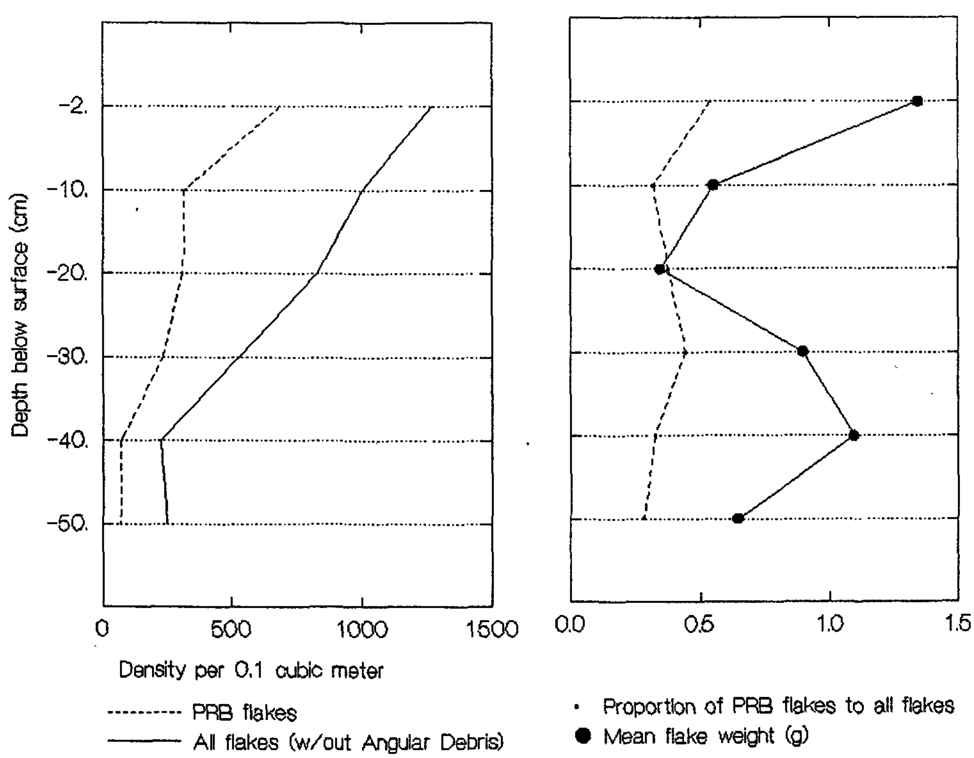

Unit 1 -- Opalite debitage
Depth below surface (cm)
-2.
-10.
-20.
-30.
-40.
-50.
0
500
1000
1500
0.0
0.5
1.0
1.5
Density per 0.1 cubic meter
PRB flakes
All flakes (w/out Angular Debris)
Proportion of PRB flakes to all flakes
Mean flake weight (g)


Unit 2 -- Opalite debitage
Depth below surface (cm)
-2.
-10.
-20.
-30.
-40.
-50.
0
500
1000
1500
0.0
0.5
1.0
1.5
Density per 0.1 cubic meter
PRB flakes
All flakes (w/out Angular Debris)
Proportion of PRB flakes to all flakes
Mean flake weight (g)

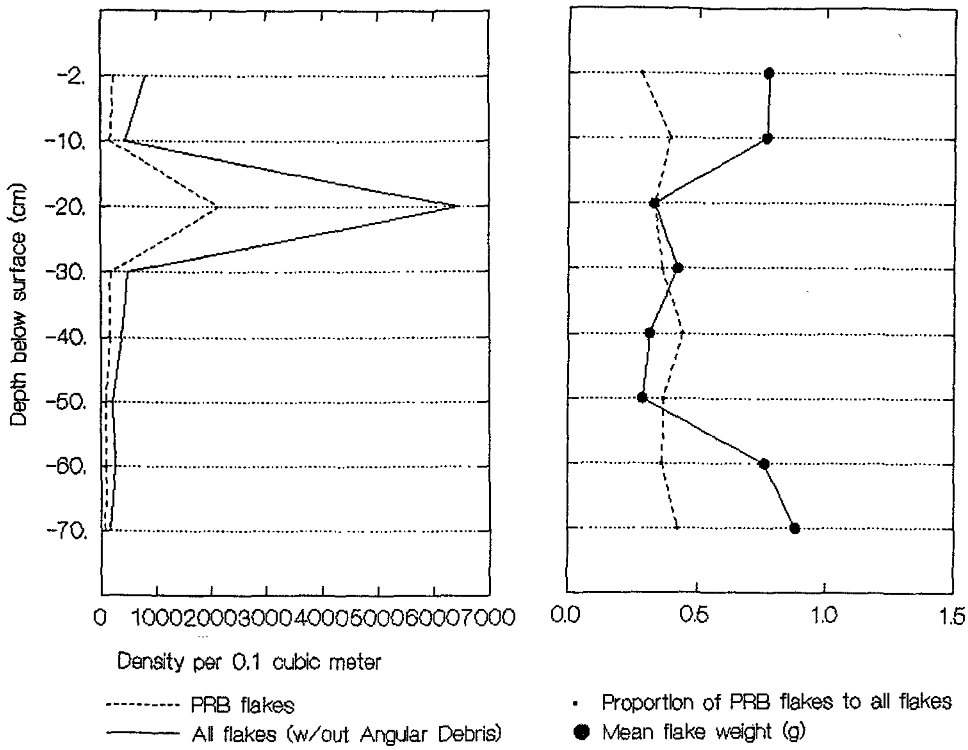
Unit 3 -- Opalite debitage



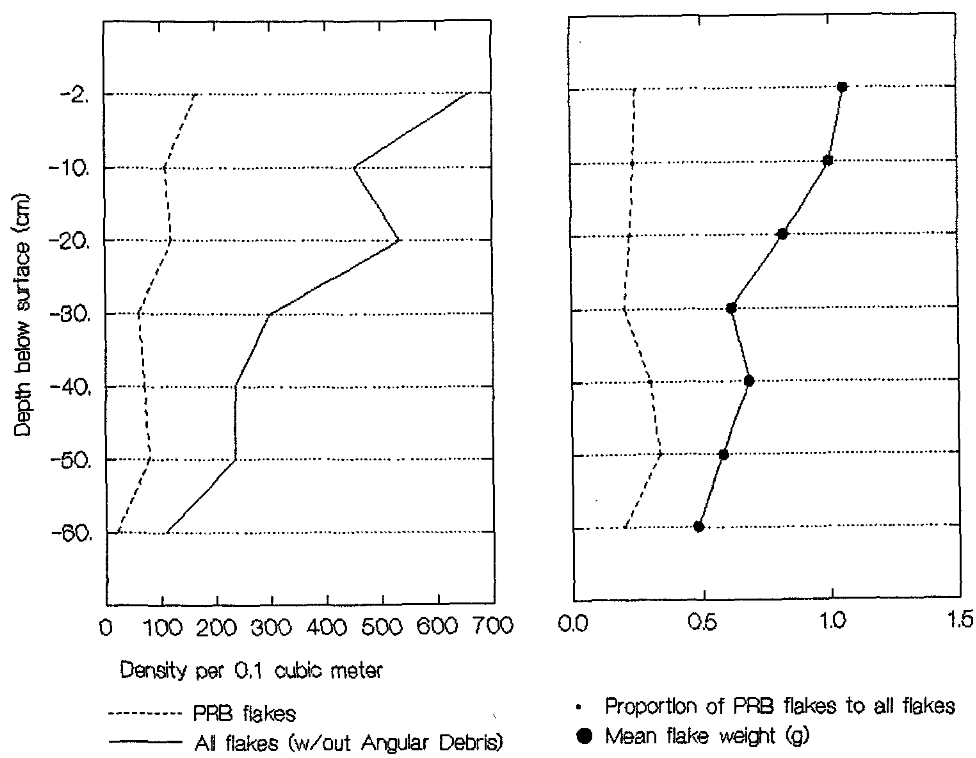
Unit 4 -- Opalite debitage



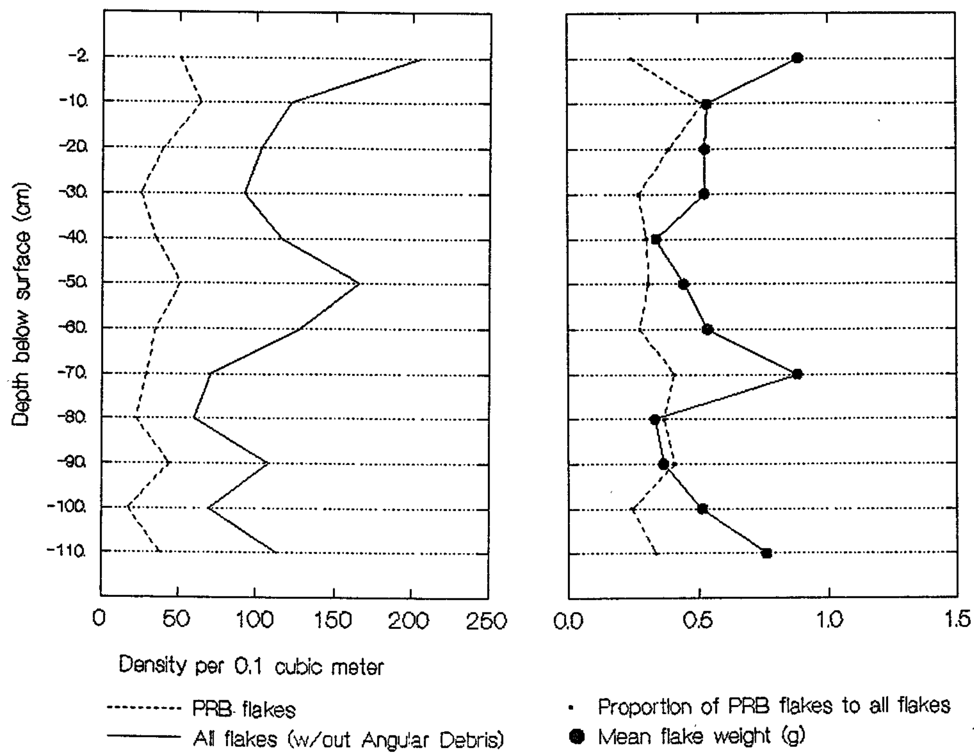
Unit 5 -- Opalite debitage



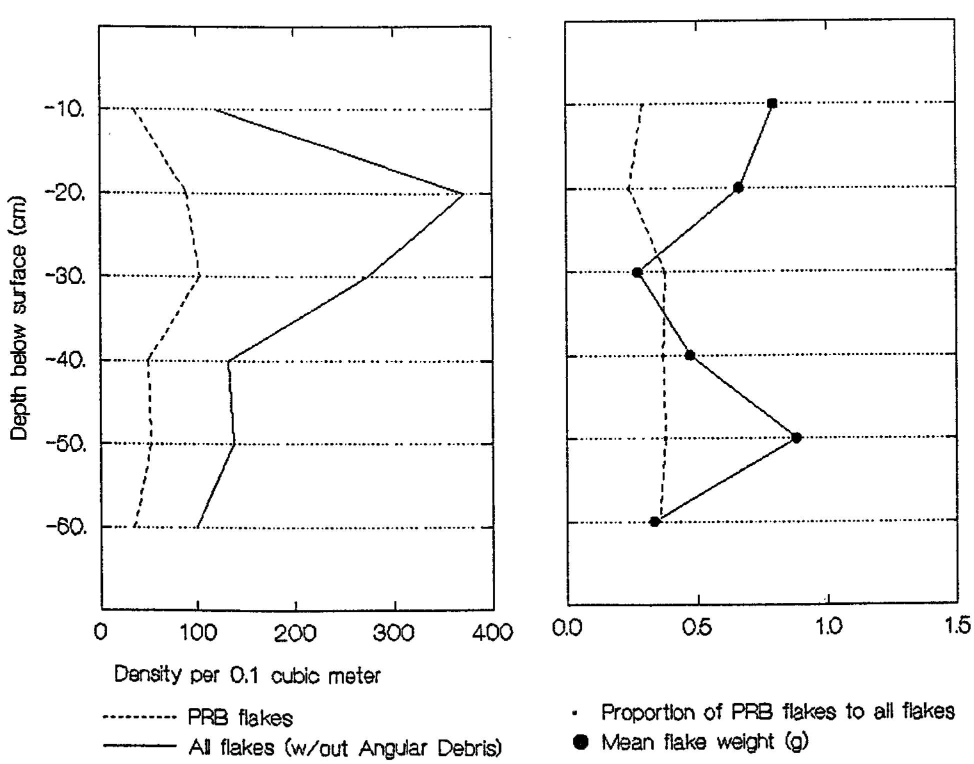
Unit 6 -- Opalite debitage



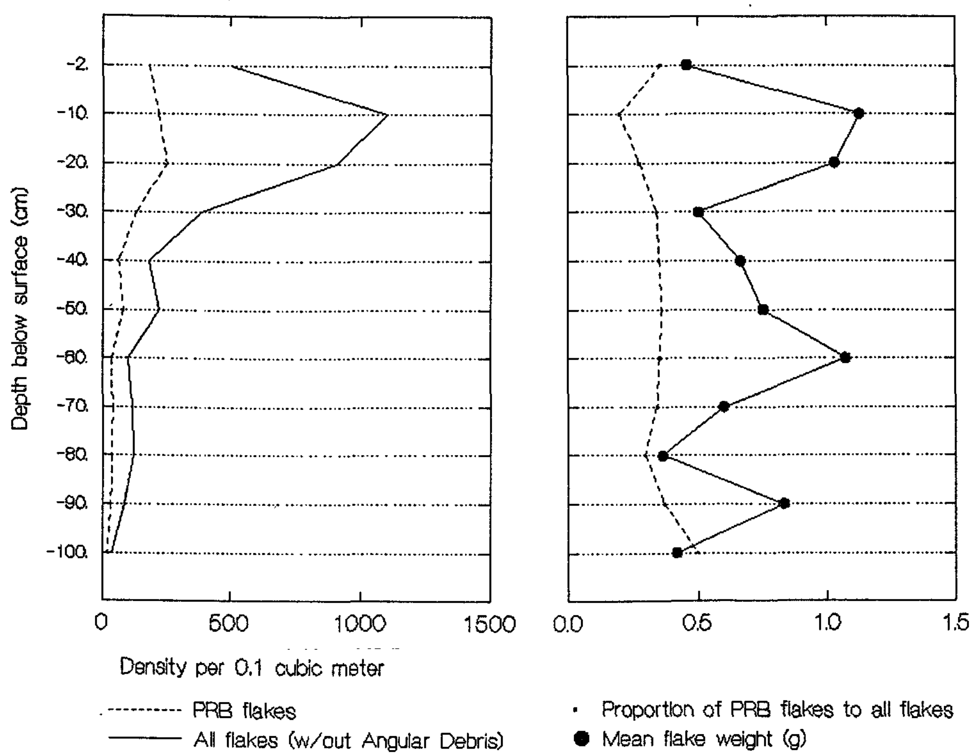
Unit 7 -- Opalite debitage



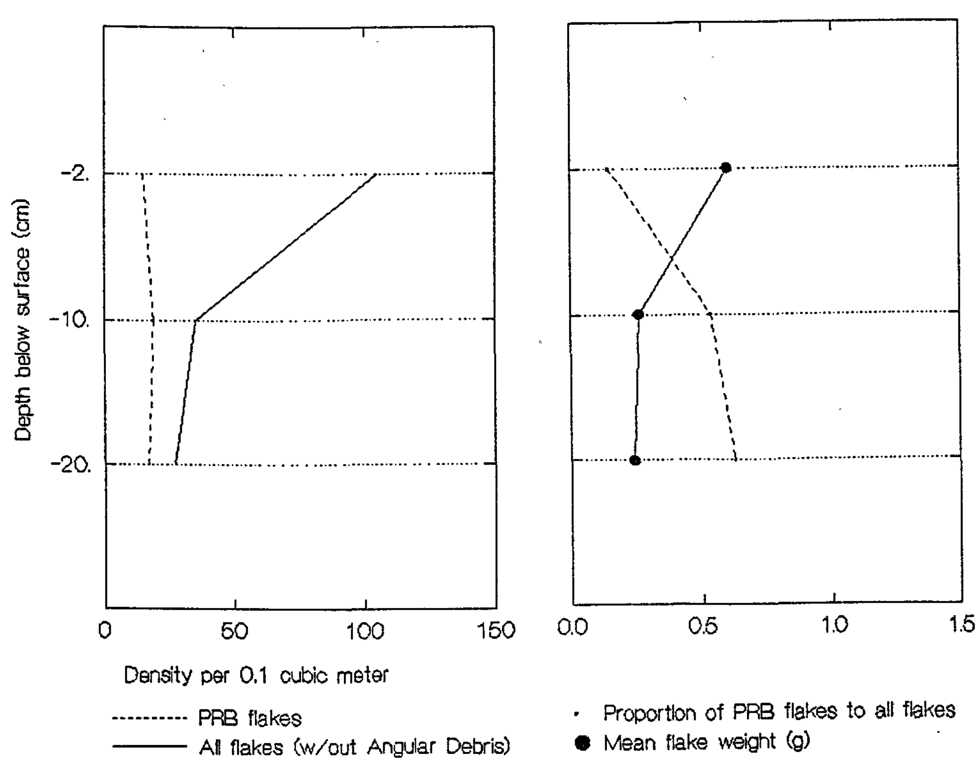
Unit 8 -- Opalite debitage



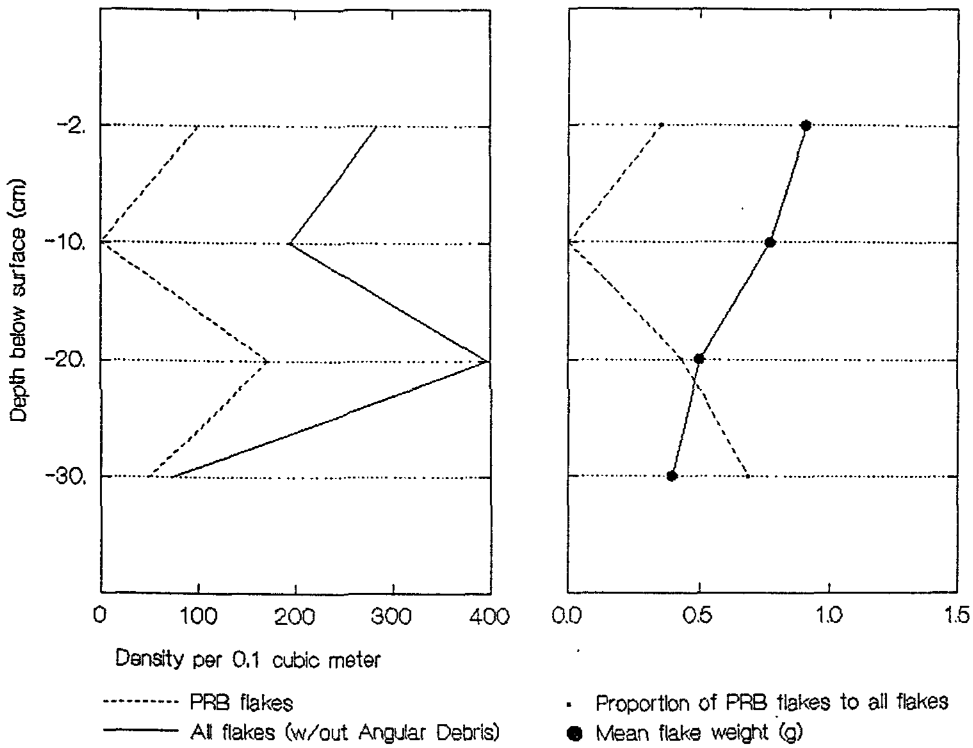
Unit 9 -- Opalite debitage



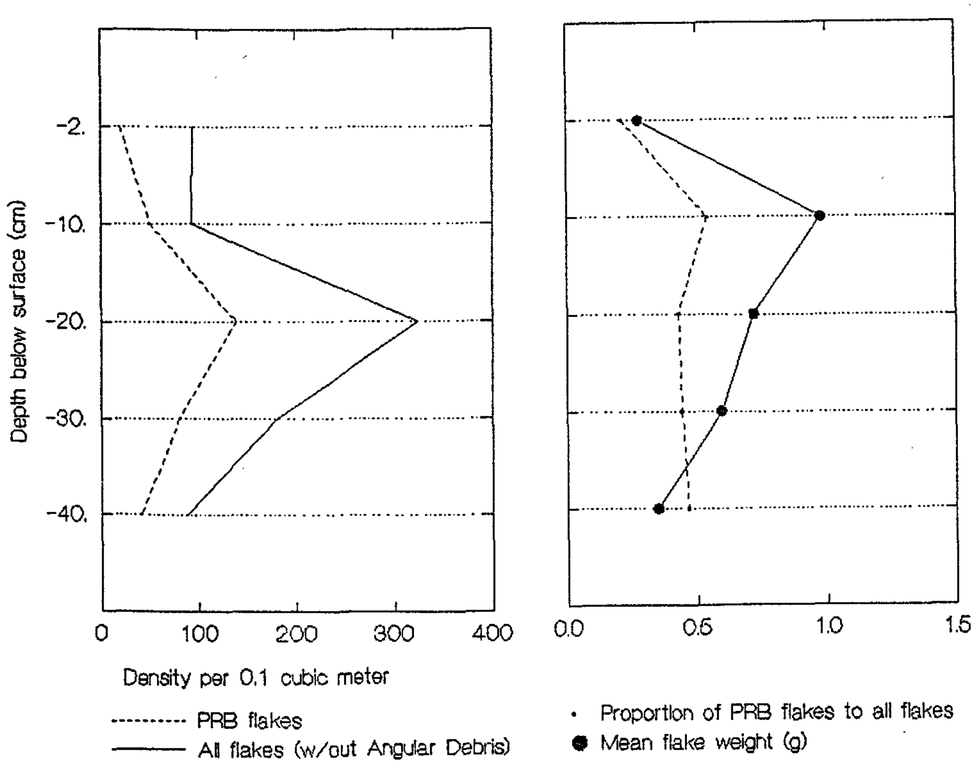
Unit 10 -- Opalite debitage

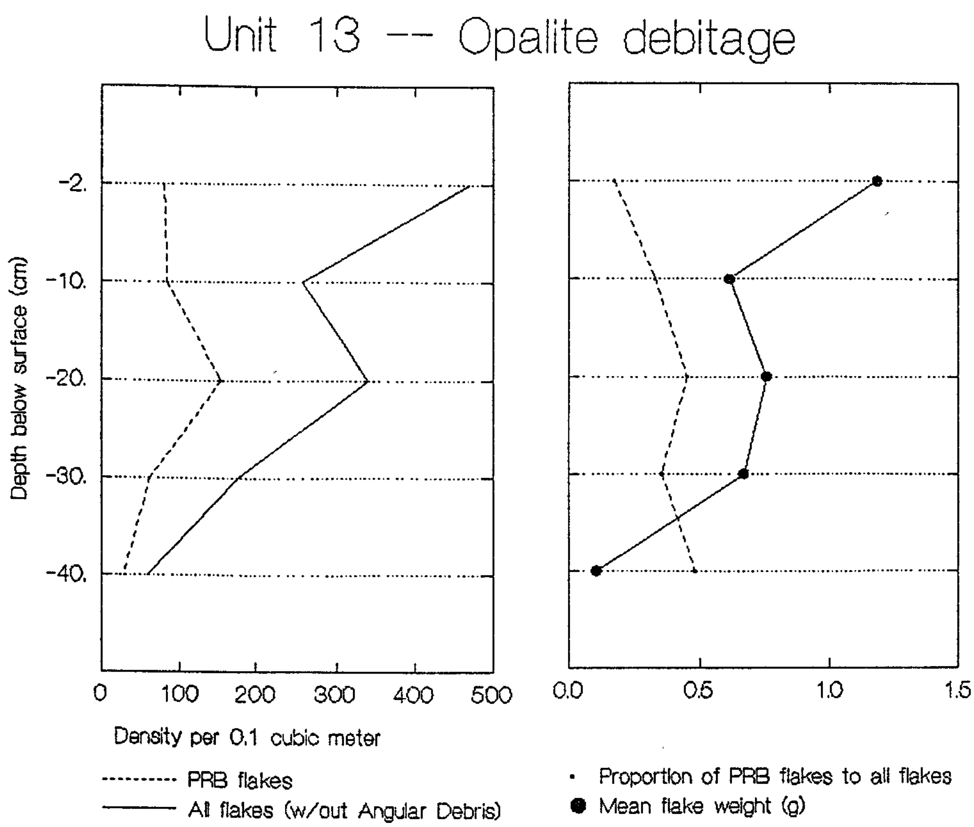


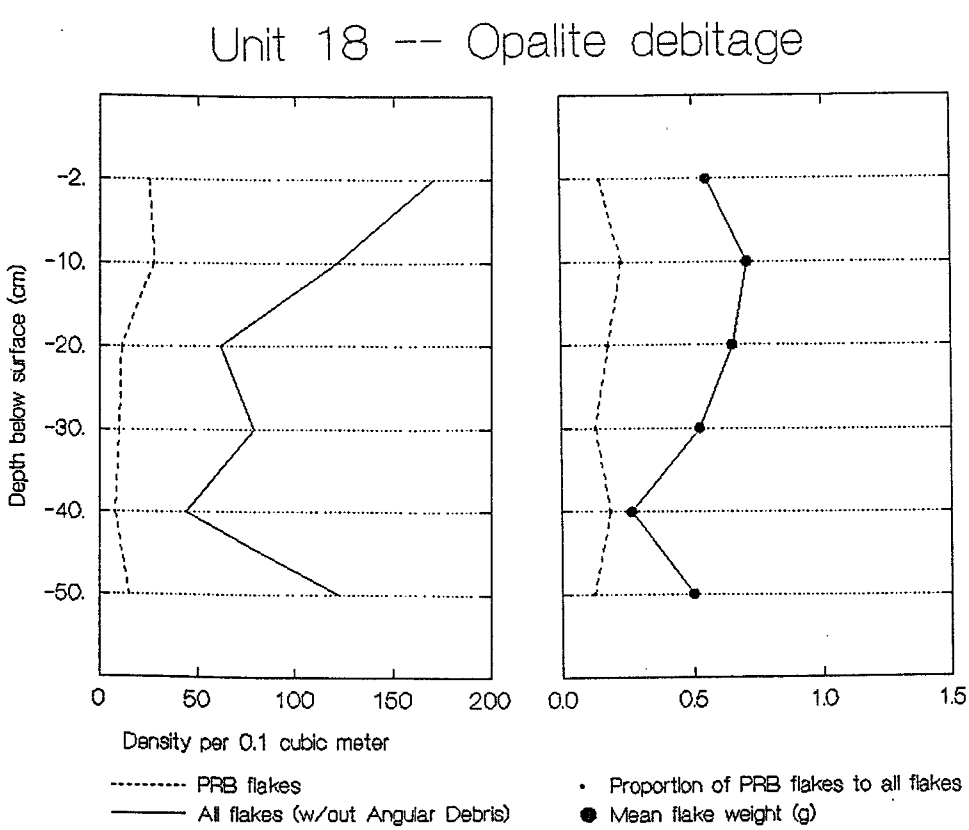
Unit 11 -- Opalite debitage



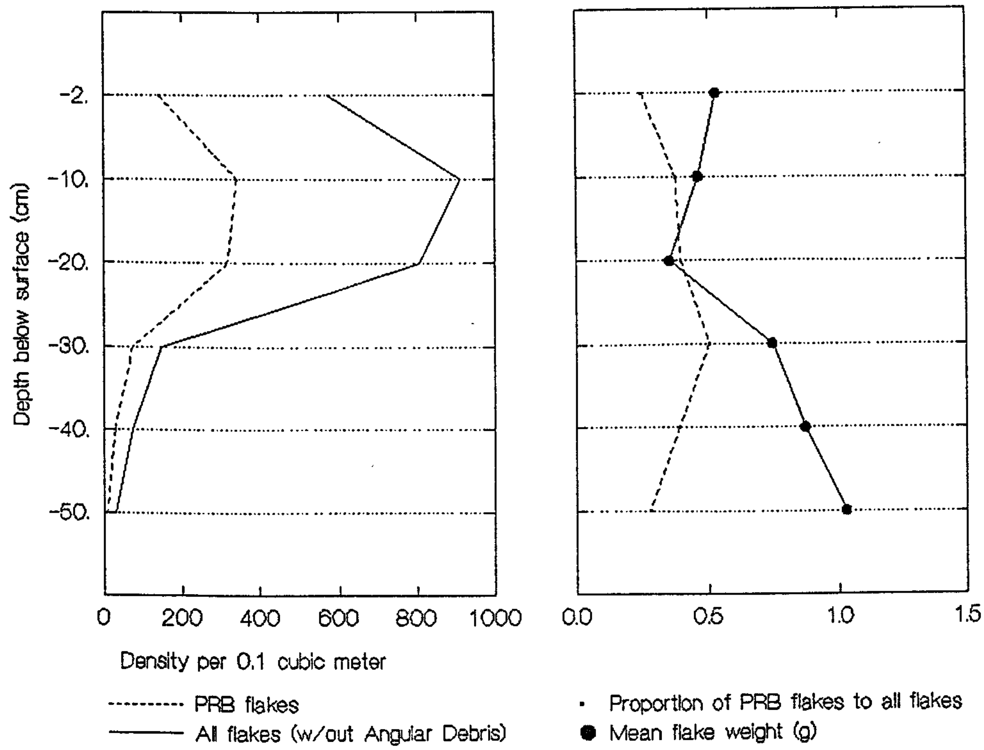
Unit 12 -- Opalite debitage



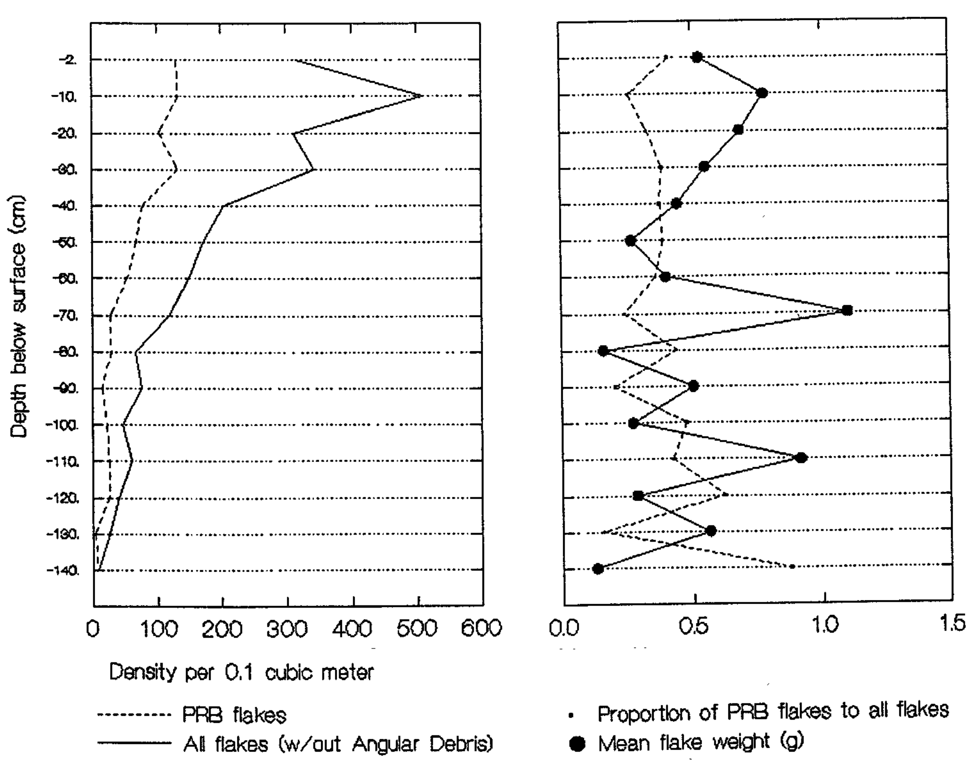

Unit 13 -- Opalite debitage
Depth below surface (cm)
-2.
-10.
-20.
-30.
-40.
0
100
200
300
400
500
Density per 0.1 cubic meter
0.0
0.5
1.0
1.5
PRB flakes
All flakes (w/out Angular Debris)
Proportion of PRB flakes to all flakes
Mean flake weight (g)


Unit 18 -- Opalite debitage
Depth below surface (cm)
-2.
-10.
-20.
-30.
-40.
-50.
0
50
100
150
200
Density per 0.1 cubic meter
0.0
0.5
1.0
1.5
PRB flakes
All flakes (w/out Angular Debris)
Proportion of PRB flakes to all flakes
Mean flake weight (g)

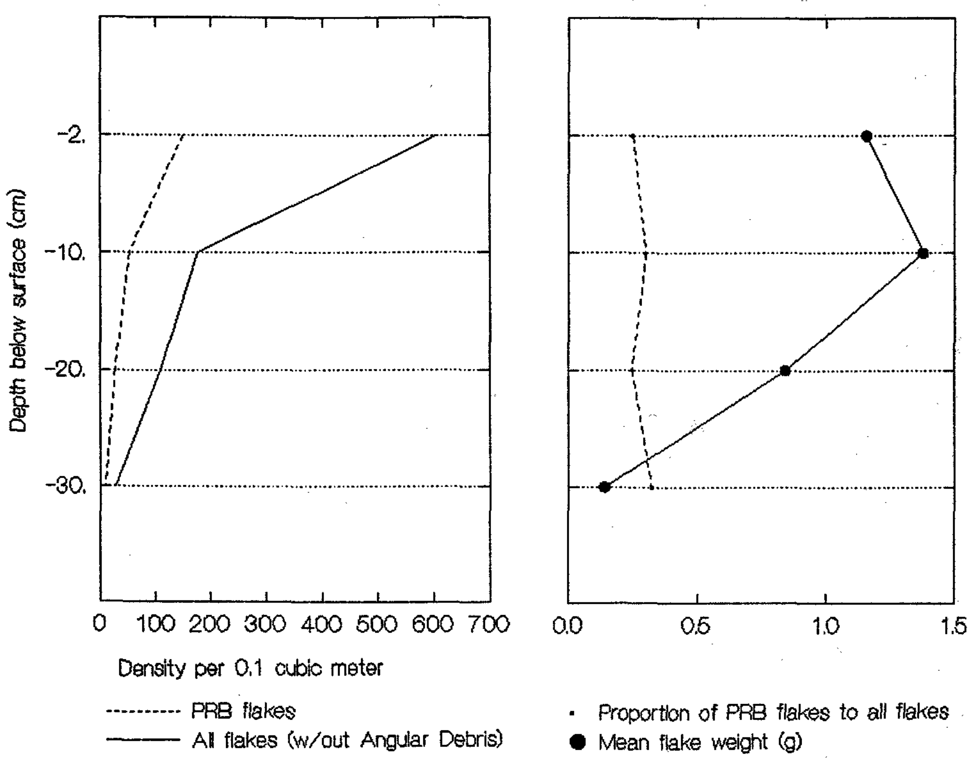
Unit 19 -- Opalite debitage



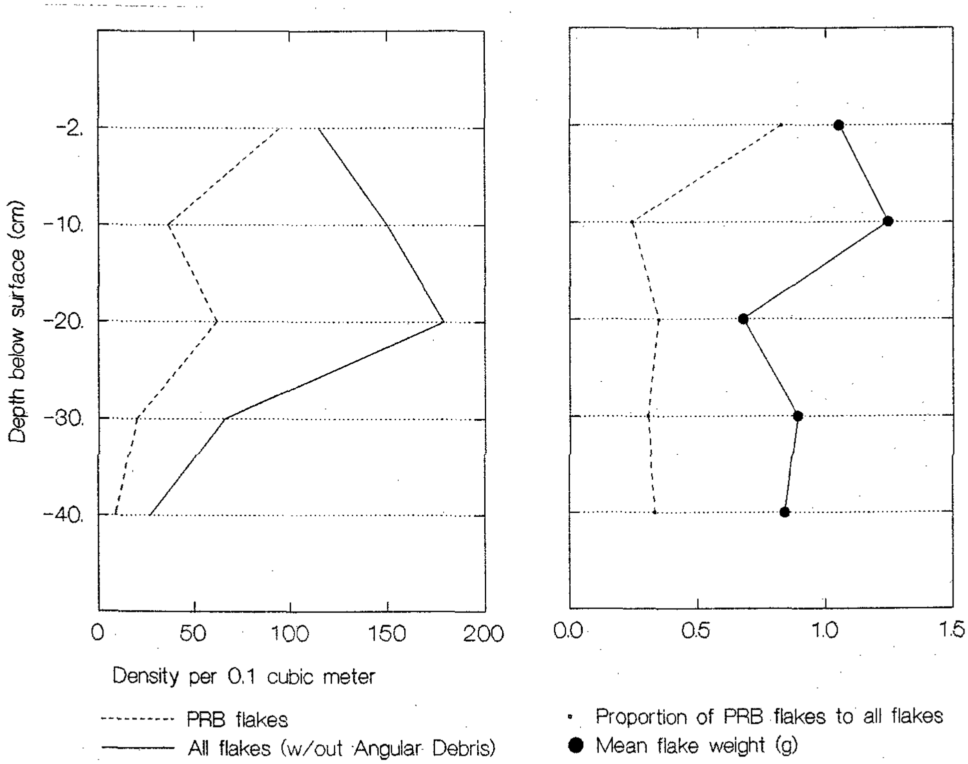
Unit 20 -- Opalite debitage



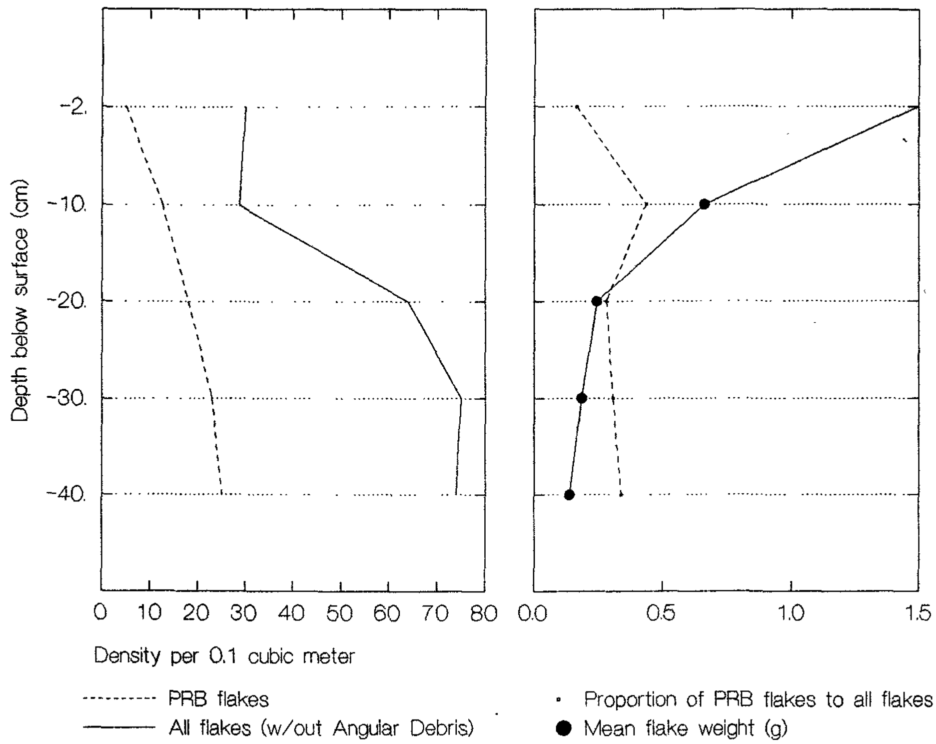
Unit 21 -- Opalite debitage



Unit 23 -- Opalite debitage



Unit 25 -- Opalite debitage



Unit 27 -- Opalite debitage